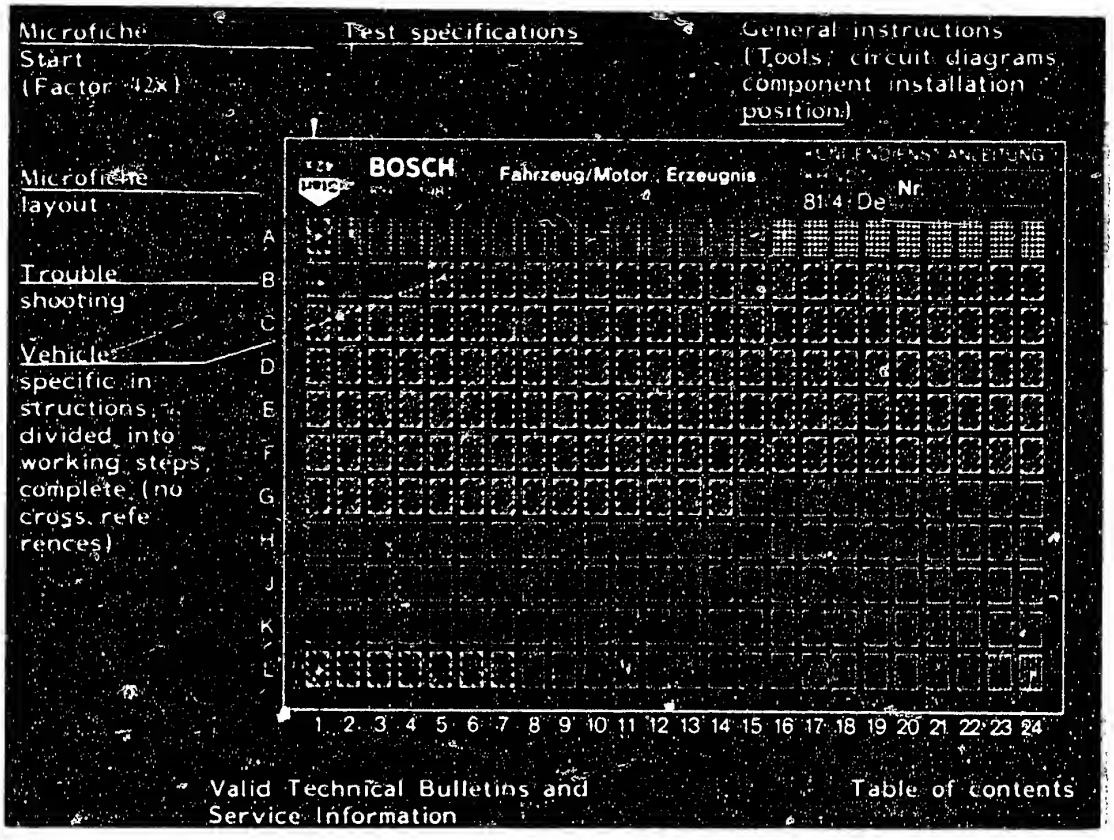
Microfiche layout



1. Read from left to right

2. Title of microfiche (appears on each coordinate)

E16	Product/assembly/test step Vehicle/engine	

E16 — Coordinate

3. Limits of section

Beginning	Mid-section	End	One-page section

4. Purely vehicle-specific passages in the text are marked with a vertical bar.

5. Reference to relevant working steps in the test specifications, e.g. coordinate C6.

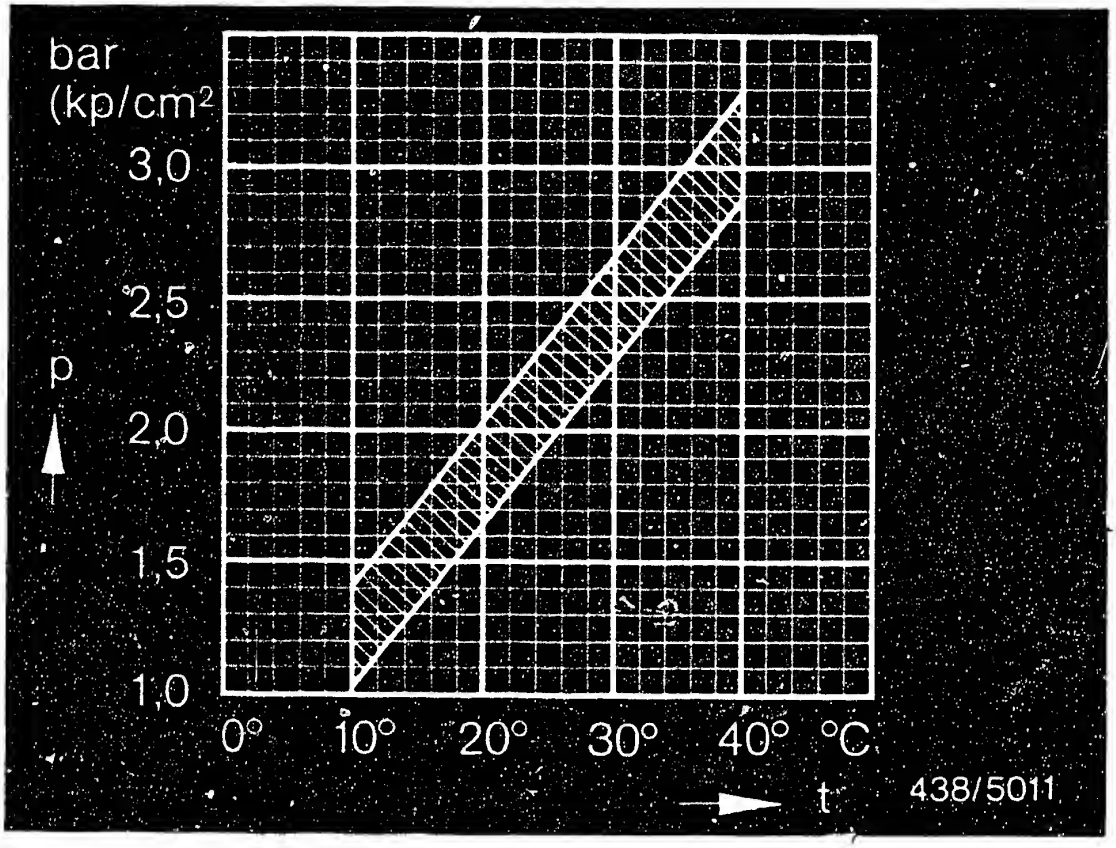
C6

1. Test Specifications

1.1 Electric fuel pump

B 21

Test step	Test specifications
Delivered fuel quantity:	at least 1050 cm^3/30 s



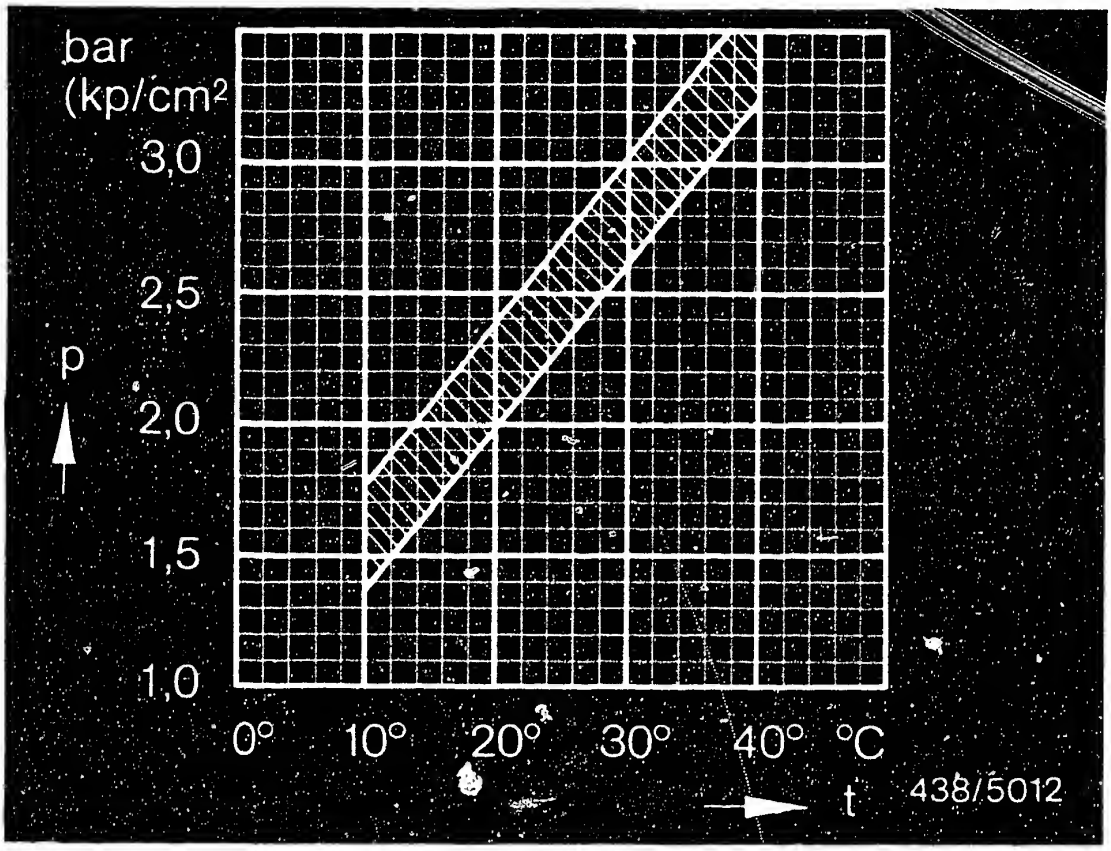
p = Control pressure (gauge pressure)
t = Ambient temperature

C 10

1.2 Control pressure "cold"

Part No. of warm-up regulator: 0 438 140 054

The test is carried out with the engine switched off, i.e. without intake-manifold pressure applied.



p = Control pressure (gauge pressure)
t = Ambient temperature

C10

Control pressure "cold"

Part No. of warm-up regulator: 0 438 140 062

The test is carried out with the engine switched off, i.e. without intake-manifold pressure applied.

Test step	Test specifications*

1.3 Control pressure "warm" — C 10

Part no. of warm-up regulator 0 438 140 054
0 438 140 062

- Test without charge-air pressure 3.45...3.85bar(3.55...3.95kgf/cm²)
- Test with simulated charge-air pressure (gauge pressure) 470...600 mbar (350...450 mmHg): 2.7...3.1 bar (2.8...3.2kgf/cm²)
- Leak test on full-load diaphragm
  Test pressure: 600 mbar (450 mmHg)
  Pressure drop: 66 mbar (50 mmHg)

1.4 Primary pressure — D 8

Checking value: 6.0...6.7 bar (6.1...6.8kgf/cm²)
Setting value: 6.2...6.5 bar (6.3...6.6kgf/cm²)

1.5 Leak test — D 15

Minimum pressure
after 10 min: 2.0 bar (2.1 kgf/cm²)
after 20 min: 1.7 bar (1.8 kgf/cm²)

* Pressures in the test-specification table are given in bar (gauge pressure) and in kgf/cm² (gauge pressure).

Test step	Test specifications*
1.6 Injection valves	E6
Opening pressure:	2.7...3.8 bar (2.8...3.9 kgf/cm²)

1.7 Fuel distributor — E16

Delivered-quantity comparison.

Fuel distributor Part No.:
0 438 100 023
0 438 100 074

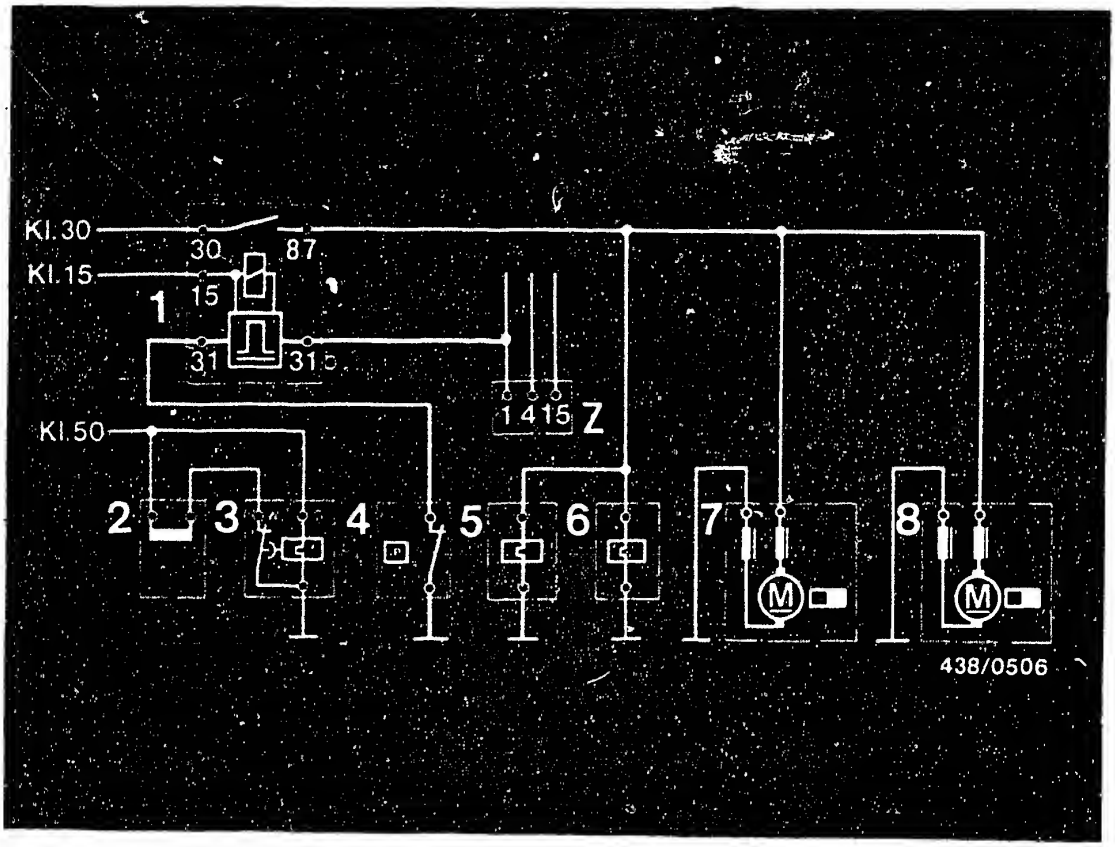
	Setting point cm³/min	Max. allowable delivery cm³/min
Idle	6.0	6.8
Part load	40.0	44.0
Full load	160.0	175.0

1.8 Idle-speed adjustment — F8

Note: Engine oil temp. approx. 80°C

Idle speed	850...950 min^{-1}
CO concentration	0.5...1.0 % by vol.

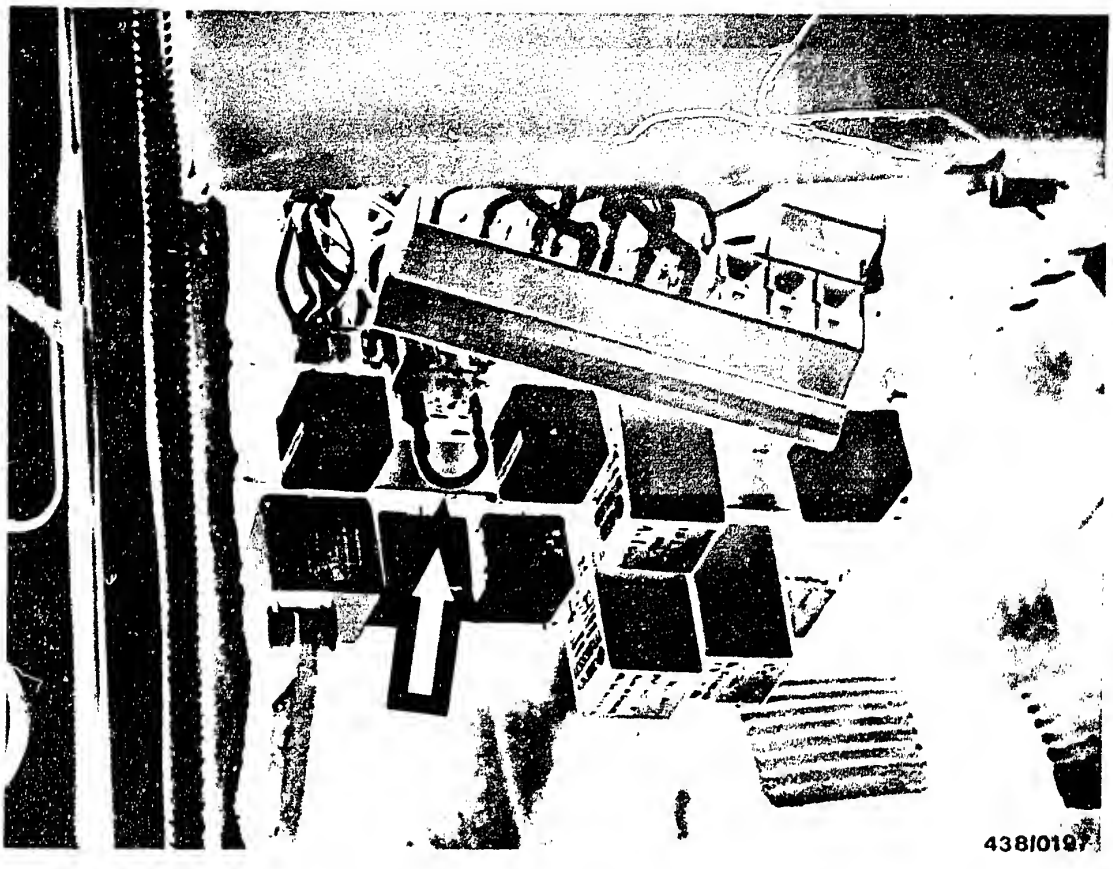
*Pressures in the test-specification table are given in bar (gauge pressure) or in kgf/cm² (gauge pressure).



2. Electrical safety circuit

2.1 Diagram

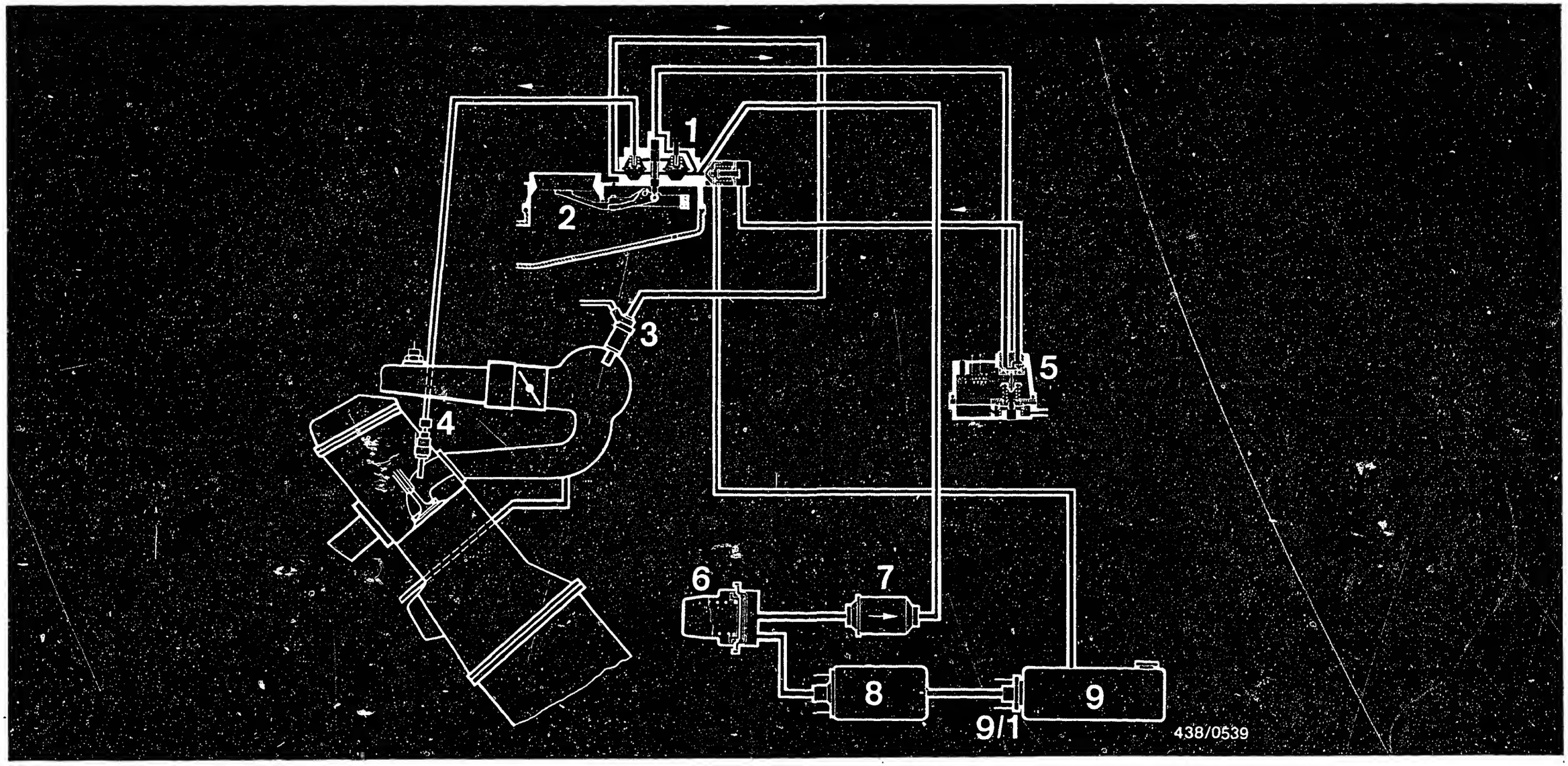
1 = Electronic relay
2 = Start valve
3 = Thermo-time switch
4 = Charge-air-pressure switch
5 = Warm-up regulator
6 = Auxiliary-air device
7 = Pre-supply pump
8 = Electric fuel pump
Z = Ignition coil



2.2 Bridging the safety circuit:

Remove the electronic rotational-speed relay from the central-electrics console. The console is located in the left-hand footwell underneath the instrument panel. The rotational-speed relay is the second relay from the left in the upper row.

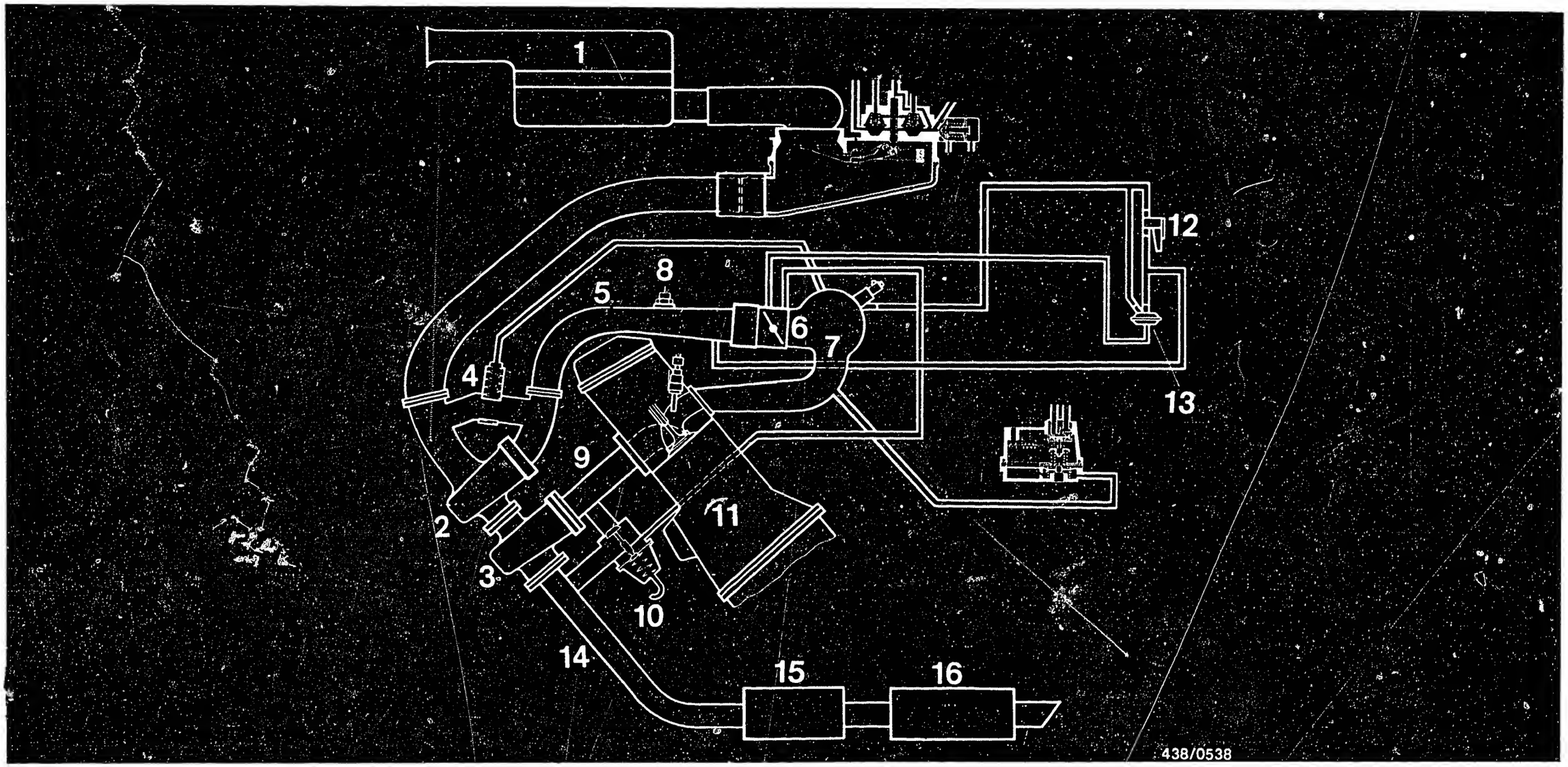
To bridge the safety circuit, connect contacts 30 and 87 using a connecting cable (arrow).



3. Diagram of fuel lines and air system

3.1 Diagram of fuel lines

1 = Fuel distributor
2 = Air-flow sensor
3 = Start valve
4 = Injection valve
5 = Warm-up regulator
6 = Fuel accumulator
7 = Fuel filter
8 = Electric fuel pump
9 = Fuel tank
9/1 = Pre-supply pump



3.2 Air system:

1 = Air filter
2 = Turbocharger compressor
3 = Turbocharger turbine
4 = Blow-off valve
5 = Pressure line (Carrera with charge-air cooler)
6 = Throttle valve
7 = Air distributor
8 = Charge-air pressure monitoring switch
9 = Exhaust manifold
10 = Wastegate
11 = Engine
12 = Auxiliary-air device
13 = Vacuum limiter
14 = Exhaust pipe
15 = Front muffler
16 = Rear muffler

4. General Information

4.1 Introduction:

This repair manual refers to the two Porsche models 924 Turbo and Turbo Carrera from the start of series production, and gives a concise description of the testing and adjustment operations to be performed on the vehicle on the K-Jetronic.

All the system components are dealt with in separate working steps with the corresponding test specifications.

In addition to this repair manual the appropriate testing and repair manuals will, of course, be issued for every other vehicle type equipped with the K-Jetronic.

The K-Jetronic differs from other familiar fuel-injection systems in terms of both construction and operation. In order to be able to carry out the testing procedures described in this manual - and therefore to be able to assess the components - the K-Jetronic and its operation should be clearly understood. The essential points of the operation and construction of the K-Jetronic are described in Technical Instruction VDT-U 3/1 En.

4.2 Design:

The entire system of the K-Jetronic in the Porsche 924 Turbo and Turbo-Carrera corresponds, with the exception of the differences listed below, to the basic design as described in Technical Instruction VDT-U 3/1 En.

4.3 The following components are different or extra:

- Pre-supply pump (not made by Bosch), installed in the fuel tank. When testing the electric fuel pump (testing the fuel delivery) the possible influence of the pre-supply pump must be borne in mind.

- 4-cylinder mixture-control unit for the first time with downdraft air-flow sensor.

- Fuel distributor with adjustable differential-pressure valves. With this type of fuel distributor, screw plugs are situated adjacent to the fittings for the fuel-injection lines.
  This adjustment possibility was introduced only for production at the works. This does not result in any additional adjustment possibilities for the after-sales service organisation. For this reason, the fuel distributor is to be dealt with in precisely the same manner as the conventional model. The screw plugs must not be removed or loosened.

- Warm-up regulator for charge-air-pressure-dependent full-load enrichment. The operation of this warm-up regulator is basically the same as that of the known version for intake-manifold-pressure-controlled full-load enrichment. However, enrichment (control-pressure reduction) does not take place during normal (naturally aspirated) engine operation, but only when there is charge-air pressure (gauge pressure) in the intake manifold.
  For special information on testing see Coordinate C10.

- Electrical safety circuit:

  The components - electric fuel pump (with pre-supply pump), warm-up regulator and auxiliary-air device - are triggered by an electronic rotational-speed relay. With the engine stopped and the ignition on, this prevents the electric fuel pumps from starting to operate and prevents the warm-up regulator and auxiliary-air device from shutting off prematurely.

  A charge-air-pressure monitoring switch is installed in the air intake pipe (pressure pipe) upstream of the throttle valve. If the charge-air pressure of the turbo-charger rises above a value of 1.1 - 1.4 bar, the switch cuts the ground connection to the rotational-speed relay, and the two electric fuel pumps are switched off.

When trouble-shooting the K-Jetronic it is assumed that the ignition is in order and that the engine is in proper mechanical condition.

The individual test steps of this repair manual are detailed and self-contained. This permits direct trouble-shooting without having to go through the entire test program for each fault.

The trouble-shooting chart on Coordinates B1 - B4 is intended to make it easier to decide which test steps have to be performed for certain faults.

According to the symptom stated by the customer or which you have determined yourself, select the possible cause in the trouble-shooting chart. The coordinate at the end of the cause column refers to the appropriate test step with the associated test specification.

Important note:

If any fuel connections are loosened, parts removed (also on the vacuum system), always use new seals when reconnecting or when re-installing.

Ensure utmost cleanliness when working on the K-Jetronic. Fuel connections must be cleaned thoroughly on the outside before opening.

5. Test equipment and tools

5.1 Pressure tester KDJE-P 100 (previously KDEP 1034).

For testing all fuel pressures and testing for leaks.

5.2 Connecting-parts set KDJE-P 100/10 (previously KDEP 1034/10).

For connecting the pressure tester.

5.3 Adjusting wrench KDEP 1035.

For adjusting the idle-mixture-adjusting screw in the mixture-control unit (idle adjustment).

5.4 Guide ring KDEP 1040/12 (Ø 76 mm).

For centering the air-flow sensor plate in the air-flow sensor.

5.5 Tester for delivered quantity comparison KDJEP-P 200 (previously KDJE 7451).

For comparing the fuel delivered from the individual fuel-distributor outlets.

5.6 Line set KDJE-P 200/25 (previously KDJE 7451/25).

For connecting the tester for delivered quantity comparison KDJE-P 200.

Note:
The Porsche 924 Turbo is fitted with steel injection lines with Polyamide intermediate pieces.
To prevent damage to the lines, they may only be bent slightly in the short Polyamide area.
The tester for delivered quantity comparison must, therefore, only be connected using the adaptor line set KDJE 7451/25.

5.7 Graduate (commercially available, capacity approx. 1.5 l).
For measuring the delivery of the electric fuel pump.

5.8 Electrical connection (test lead)
KDJE 7450/70 for direct connection to components to be tested, e.g. cold-start valve.

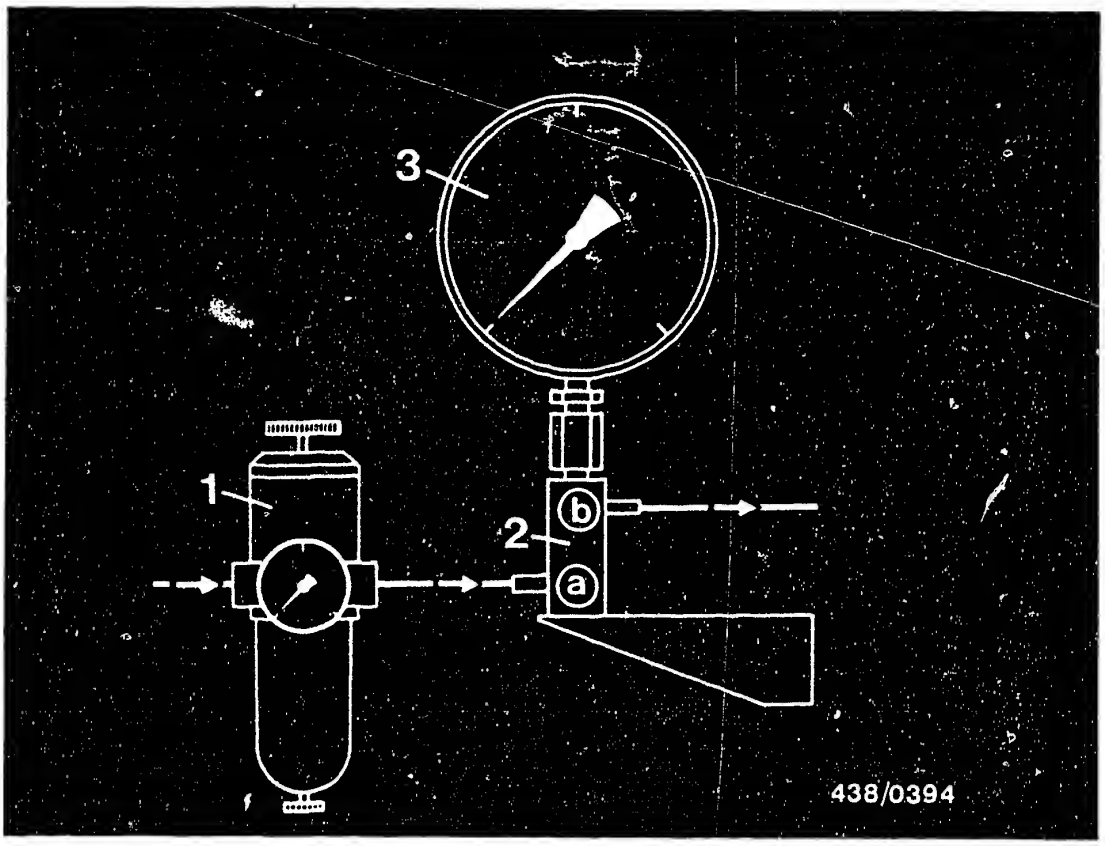
5.9 Valve tester KDJE-P 400 (previously KDJE 7452).
For testing the injection valves.

Test media: Calibrating fluid (Shell K 30, Esso-Varsol, Shell Mineral Spirits 135)
or
Bosch Part Designation VS 14 942-CH
previously Part No. 5 973 340 650
The calibrating fluid can be obtained in 5 l metal cans from the following supplier:
Firma
Oskar Gnamm GmbH & Co
D-7531 Kämpfelbach-Bilfingen

Caution:
For safety reasons, never use normal gasoline or similar easily inflammable and combustible liquids. Even with calibrating fluid, be sure to observe the local official regulations.

5.10 Tachometer (commercially available)
For idle-speed adjustment.

5.11 CO meter (commercially available)
For idle-speed CO adjustment.



5.12 Testing device for full-load control pressure, consisting of:

Pressure regulator (Item 1) with pressure gauge 0...4 bar gauge pressure (commercially available, e.g. Type No. 104 from Krais und Fritz, Stuttgart).

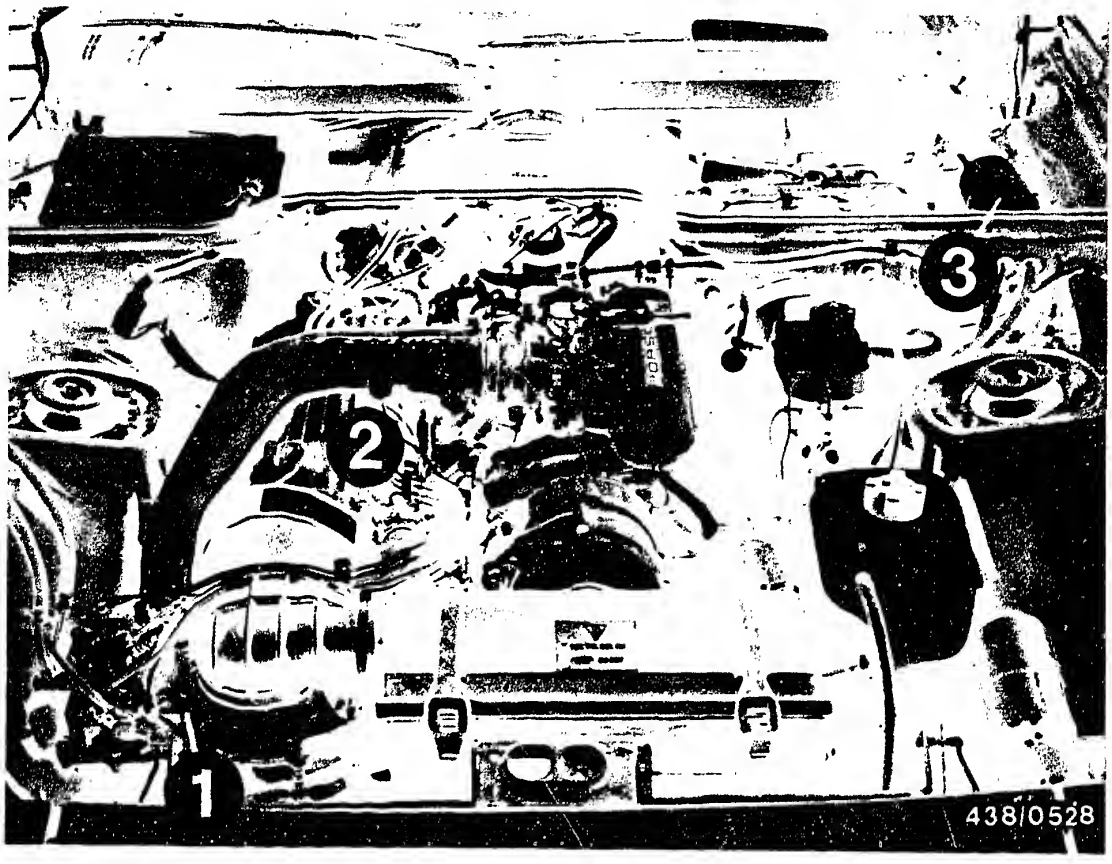
Adjusting throttle (Item 2)
Bosch 0 688 130 132.

Pressure gauge (Item 3) 0...1.6 bar gauge pressure, quality class 1.0 (commercially available, e.g. Wika No. 4184).

In order to test the full-load control pressure, air pressure corresponding to the charge-air pressure must be applied to the warm-up regulator. The pressure is taken from the compressed-air mains.

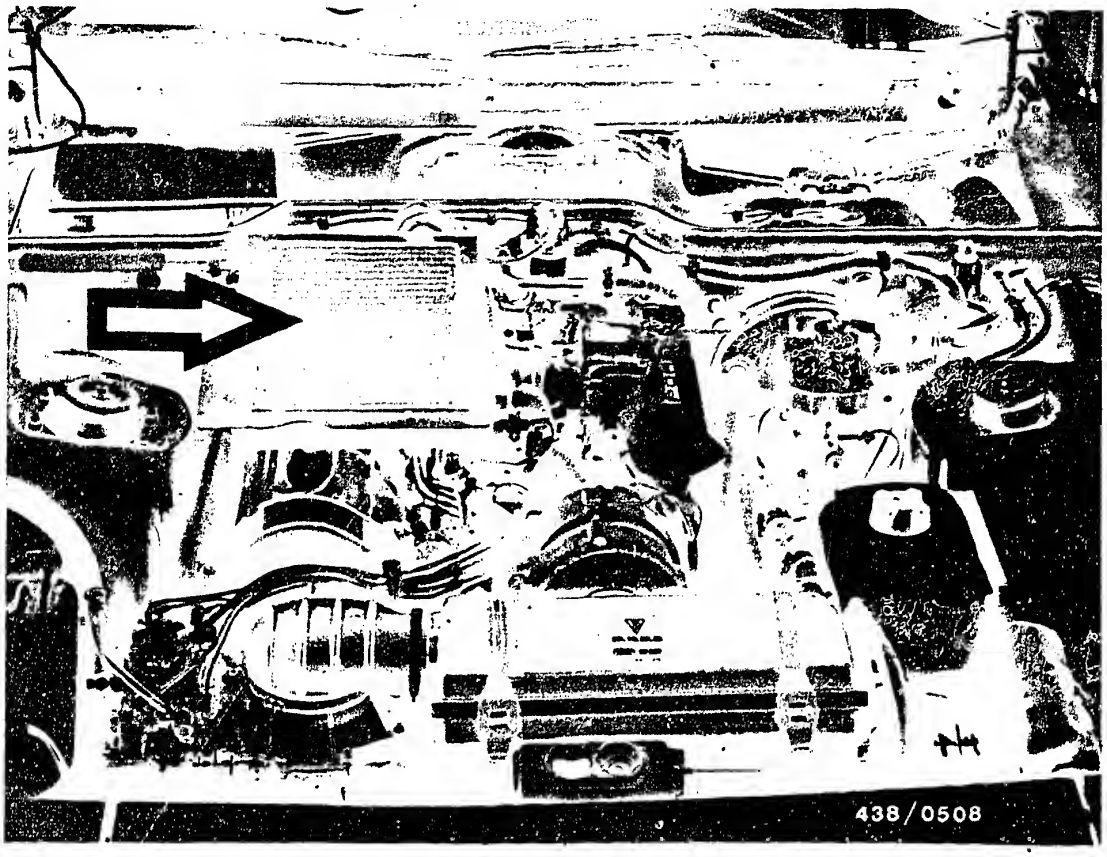
Note:
The tools and equipment listed are frequently already available in the diesel workshop and are used there for testing the manifold-pressure compensators on diesel fuel-injection pumps.

15.3 Tool set for removing and fitting the idle CO anti-tamper device of the air-flow sensor. (e.g. No. 131090 from Cartool, Hans Schubert KG, Unterer Grasweg 88/D-8070 Ingolstadt).

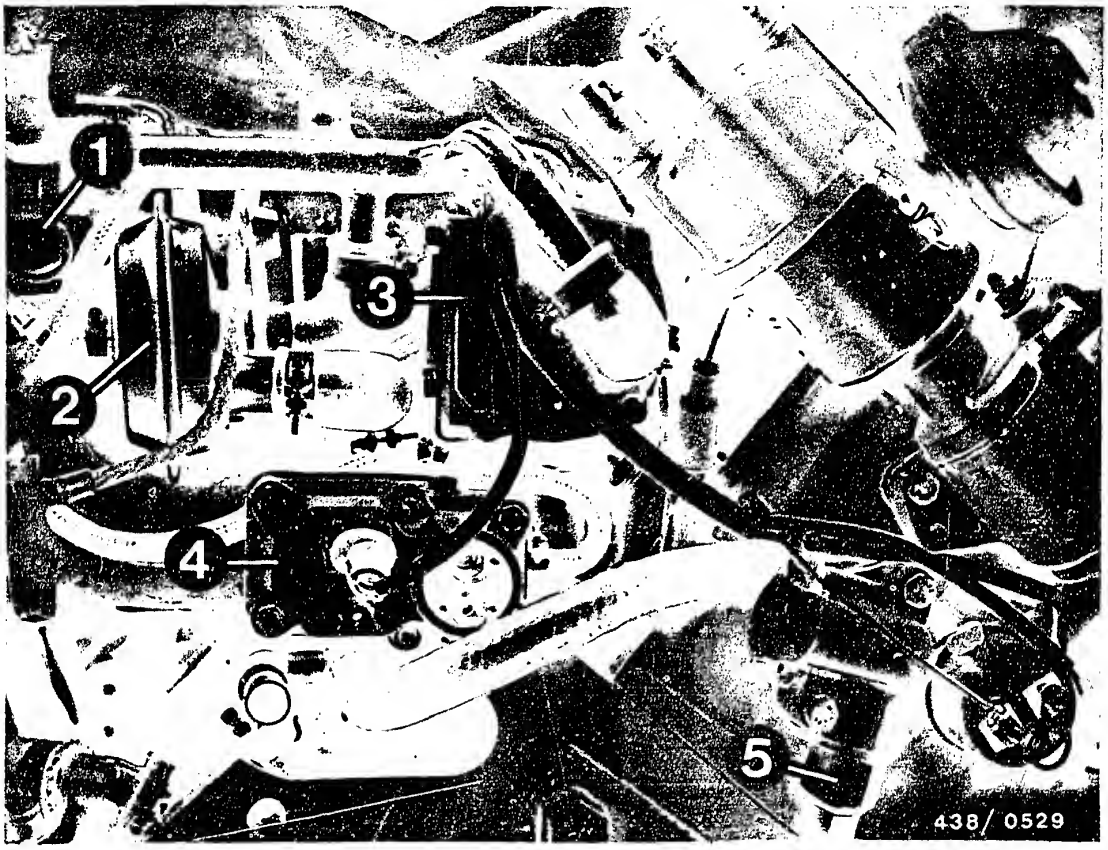


6. Installation position of individual components

1 = Mixture control unit
2 = Injection valves
3 = Fuel filter

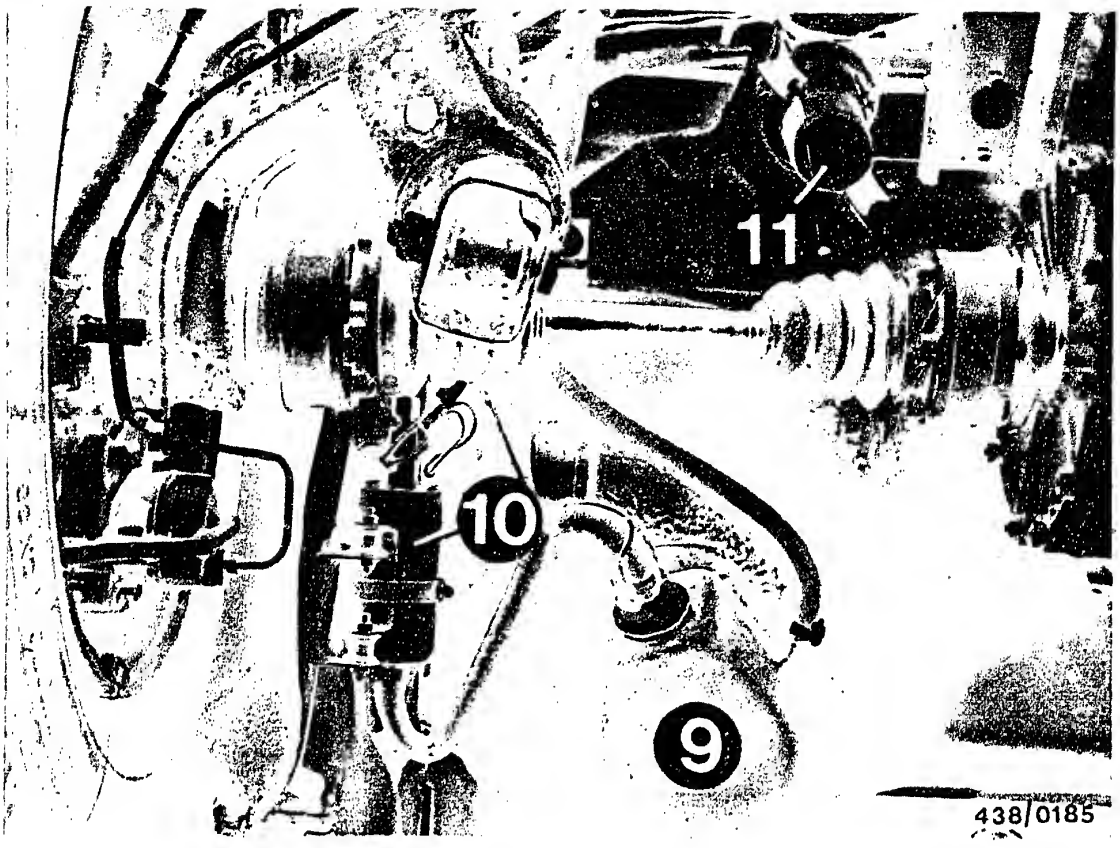


924 Turbo Carrera with charge-air cooler (arrow).



The components shown in the picture are not readily accessible and are shown with the engine removed.

1 = Start valve
2 = Vacuum limiter
3 = Auxiliary-air device
4 = Warm-up regulator
5 = Thermo-time switch



9 = Electric pre-supply pump (non-Bosch product)
10 = Electric fuel pump
11 = Fuel accummulator

7. Trouble-shooting chart

Customer complaint (fault sympton)

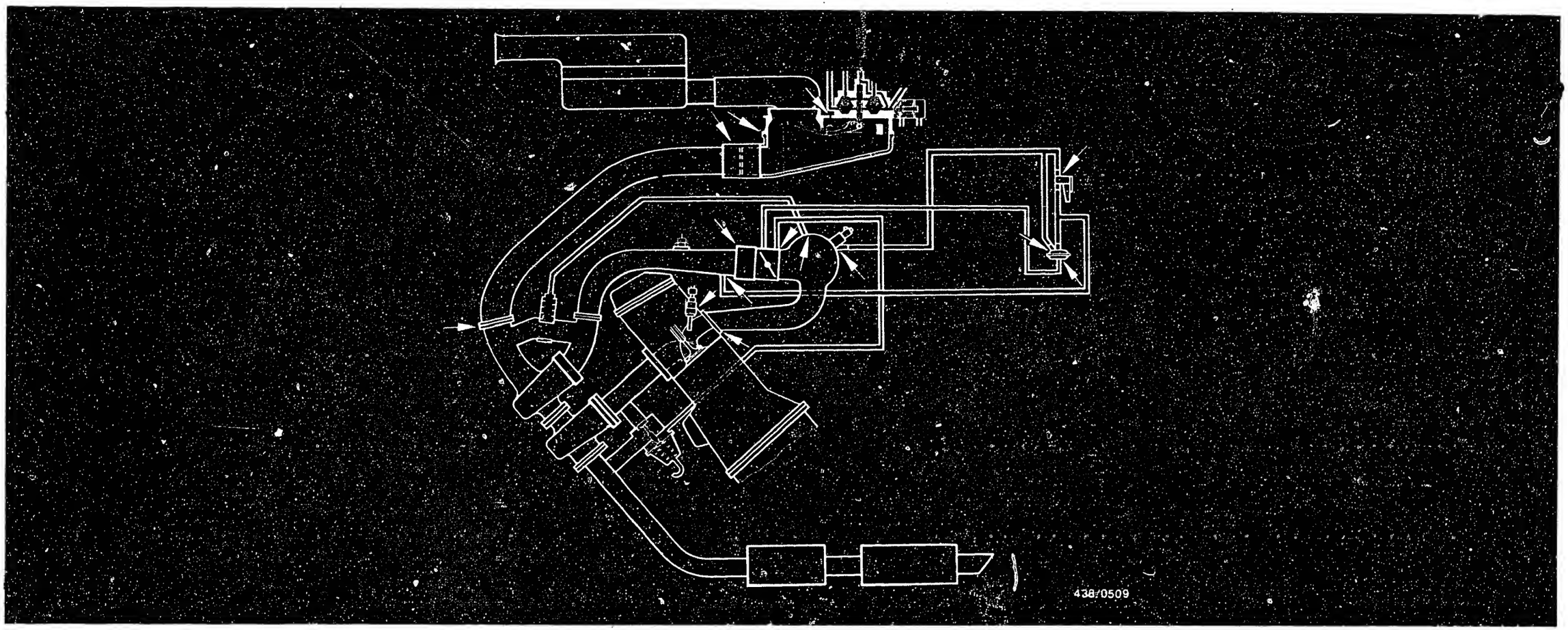
1. Engine does not start, or starts poorly, in cold condition	2. Engine does not start, or starts poorly, in warm condition*	3. Irregular idling during the warm-up phase (shakes)	4. Irregular idling with warm engine (shakes)	5. Engine does not draw gas, burbles	6. Engine misfires when operating on the road, high load	7. Insufficient power	Cause	Coordinates
	●	●	●	●		●	Vacuum system leaking	B 5
●	●		●	●	●	●	Air-flow sensor lever and/or control plunger not moving smoothly	B 7
	●						Position of the air-flow sensor plate incorrect (too high)	B 14
●		●					Auxiliary-air device does not open	B 19
							Auxiliary-air device does not close	B 19
●	●				●		Electric fuel pump not operating	B 21
●							Cold-start system defective	C 4
		●	●				Cold-start valve leaking	C 6
●		●					"Cold" control pressure outside tolerance	C 10
	●		●	●	●	●	"Warm" control pressure too high (after warm-up)	C 10
			●	●		●	"Warm" control pressure too low (after warm-up)	C 10
					●	●	Primary (system) pressure outside tolerance	D 8
	●						Overall fuel system leaking	D 15
●	●	●	●		●		Injection valves leaking, opening pressure too low	E 6
●	●	●	●			●	Unequal fuel delivery (imbalance of fuel delivery)	E 16
●	●	●	●	●			Basic idle adjustment incorrect	F 8
						●	Throttle plate does not open completely	--

*Note

If, in the case of Sympton 2, after checking and repairing all the fault causes listed below, the hot-start characteristic is still unsatisfactory this can be improved by fitting an impulse relay.
The fitting of this relay is described in Coordinates L 4.

Customer complaint (fault symptom) (continued)

8. Engine runs on after being switched off ("diesels")	9. Fuel consumption too high	10. Flat spot during acceleration	11. CO concentration during idling too high	12. CO concentration during idling too low	13. Idle-speed cannot be adjusted (too high)	14. Engine starts but then immediately stops	Cause	Coordinates
		●		●			Vacuum system leaking	B 5
●		●	●	●			Air-flow sensor lever and/or control plunger not moving smoothly	B 7
●							Position of the air-flow sensor plate incorrect (too low)	B 14
							Auxiliary-air device does not open	B 19
					●		Auxiliary-air device does not close	B 19
						●	Electric fuel pump not operating	B 21
							Cold-start system defective	C 4
●	●		●				Cold-start valve leaking	C 6
							"Cold" control pressure outside tolerance	C 10
		●				●	"Warm" control pressure too high (after warm-up)	C 10
	●	●	●			●	"Warm" control pressure too low (after warm-up)	C 10
		●				●	Primary (system) pressure outside tolerance	D 8
							Overall fuel system leaking	D 15
●							Injection valves leaking, opening pressure too low	E 6
		●					Unequal fuel delivery (imbalance of fuel delivery)	E 16
●	●	●	●	●			Basic idle adjustment incorrect	F 8
							Throttle plate does not open completely	--

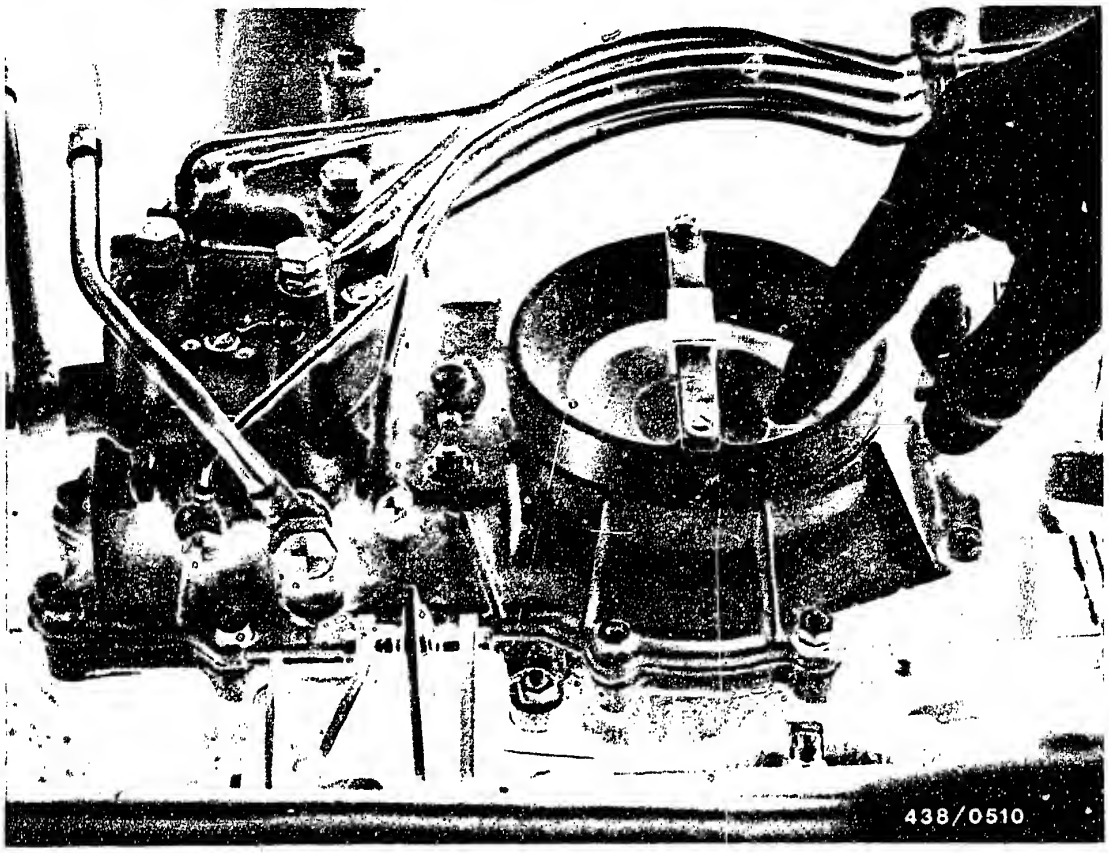


Working steps

8. Check the air-intake system of the engine for leaks

The arrows in the diagram show typical points where leaks can occur.
Check by performing a visual inspection or, in cases of doubt, as follows: Disconnect the hose from the outlet of the auxiliary-air device and blow air through this hose into the intake system using a compressed-air gun. The throttle valve is to be fully open. Brush connection points with soapy water, or spray with leak detector (e.g. Güpoflex).

Under no circumstances may combustible liquids be used when testing for leaks.
The formation of bubbles or foam indicates a leak.
If a leak has been eliminated, it is necessary finally to adjust the idle speed with the engine at normal operating temperature:
Idle-speed adjustment is described on Coordinates F 8.



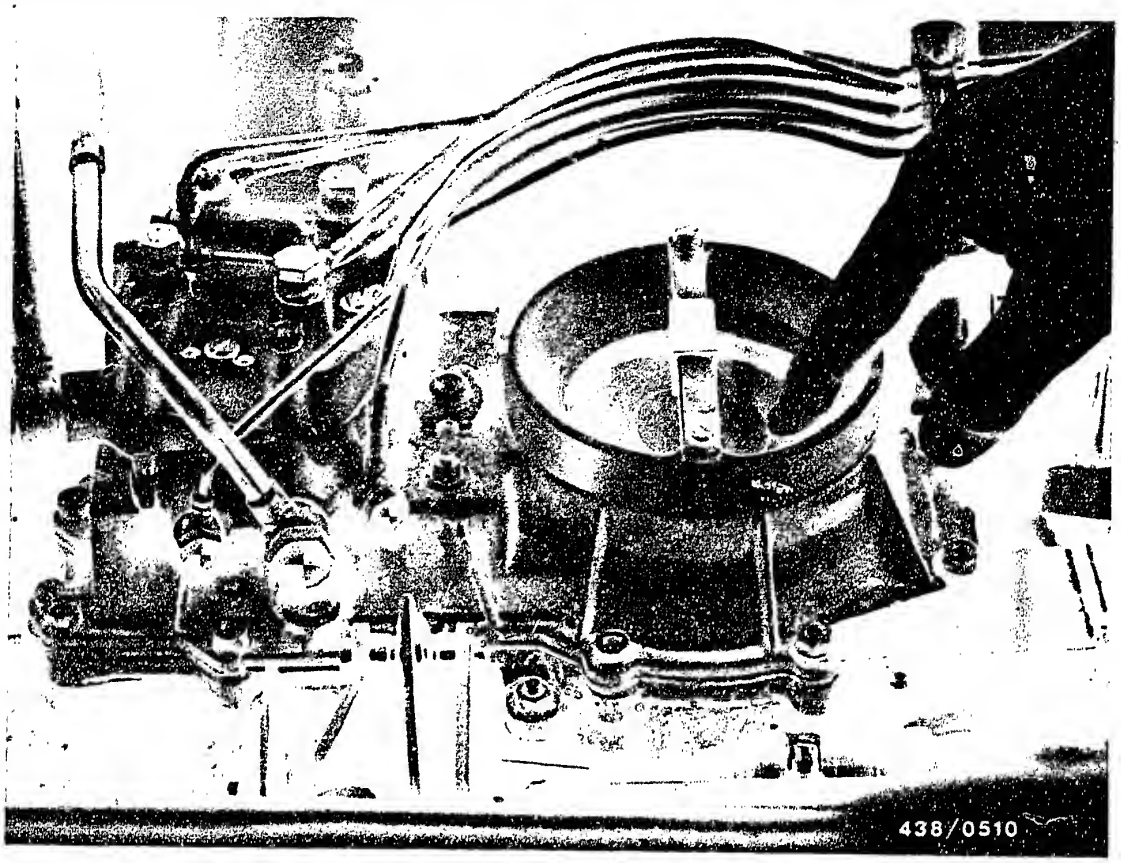
9. Check the control lever in the air-flow sensor and the control plunger in the fuel distributor for ease of movement.

9.1 Preparations

Engine temperature not below +20°C.

Remove the rubber hood (release 2 clamping brackets) so that the air-flow sensor plate becomes accessible.

Switch on the electric fuel pump for approx. 10 seconds by bridging the safety circuit.
This results in application of the control pressure to the control plunger in the fuel distributor.



9.2 Checking the control lever for freedom of movement

Depress the air-flow sensor plate by hand (downdraft) and release again. The sensor plate snaps back into the zero position and bounces up about twice from the spring-loaded stop.
If the control lever does not move freely, first release all fastening screws holding the air-flow sensor to determine whether housing deformation is the cause of the problem.
If, when the fastening screws have been released, the control lever moves freely, replace the seal between the air-guide housing and the air-flow sensor (Porsche service part).
Tighten the screws uniformly cross-wise to a torque of 9...10 Nm (0.9...1.0 kgfm). If there is no housing deformation, repair or replace the air-flow sensor.

9.3 Check that the control plunger moves freely

Depress the air-flow sensor plate by hand (downdraft). The same resistance must be felt over the entire movement.

Move the sensor plate rapidly back to a position just in front of the zero stop. The control plunger follows this rapid movement of the sensor plate only sluggishly, and therefore initially loses contact with the sensor plate lever. It must be possible, however, to feel the plunger make contact with this lever again. If this condition if fulfilled, the control plunger can be considered to move freely.

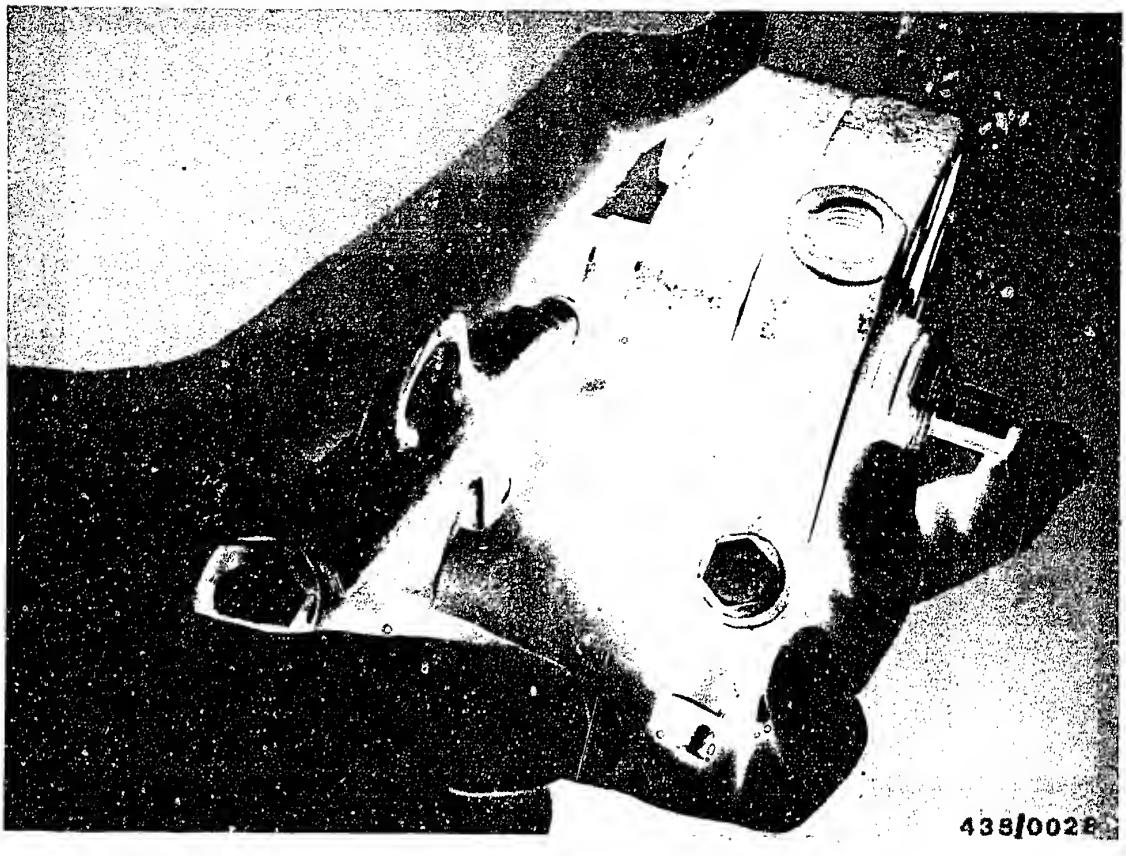
If the control plunger does not move freely, remove the fuel distributor from the air-flow sensor.

Important!
Note the following when installing fuel components and fuel lines:

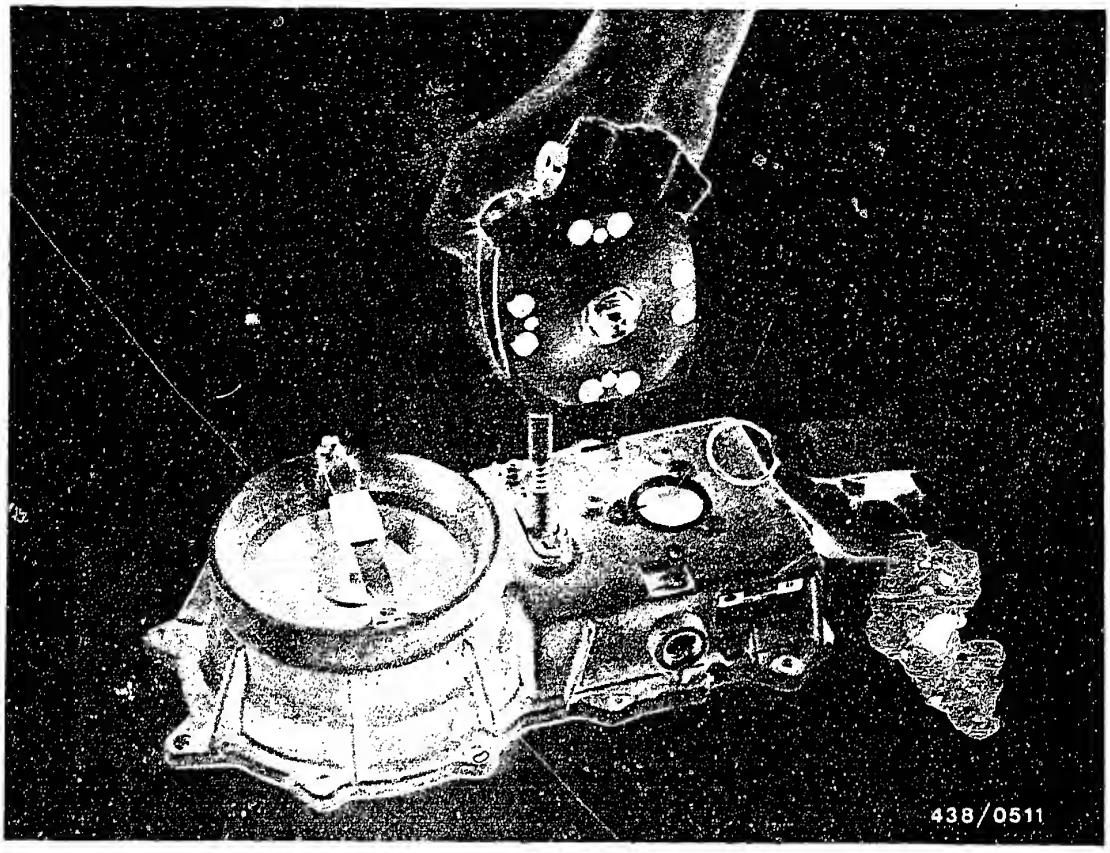
Always ensure utmost cleanliness when loosening or tightening the fuel connections. No dirt must enter the fuel system.

When loosening or tightening the fuel connections, apply counter-force at the fixed hexagon of the component.

Clean the fuel distributor thoroughly in the region of the fuel connections. Screw off all connections.
Screw out three fastening screws and remove the fuel distributor from the air-flow sensor.
The steel tubing must not be bent!

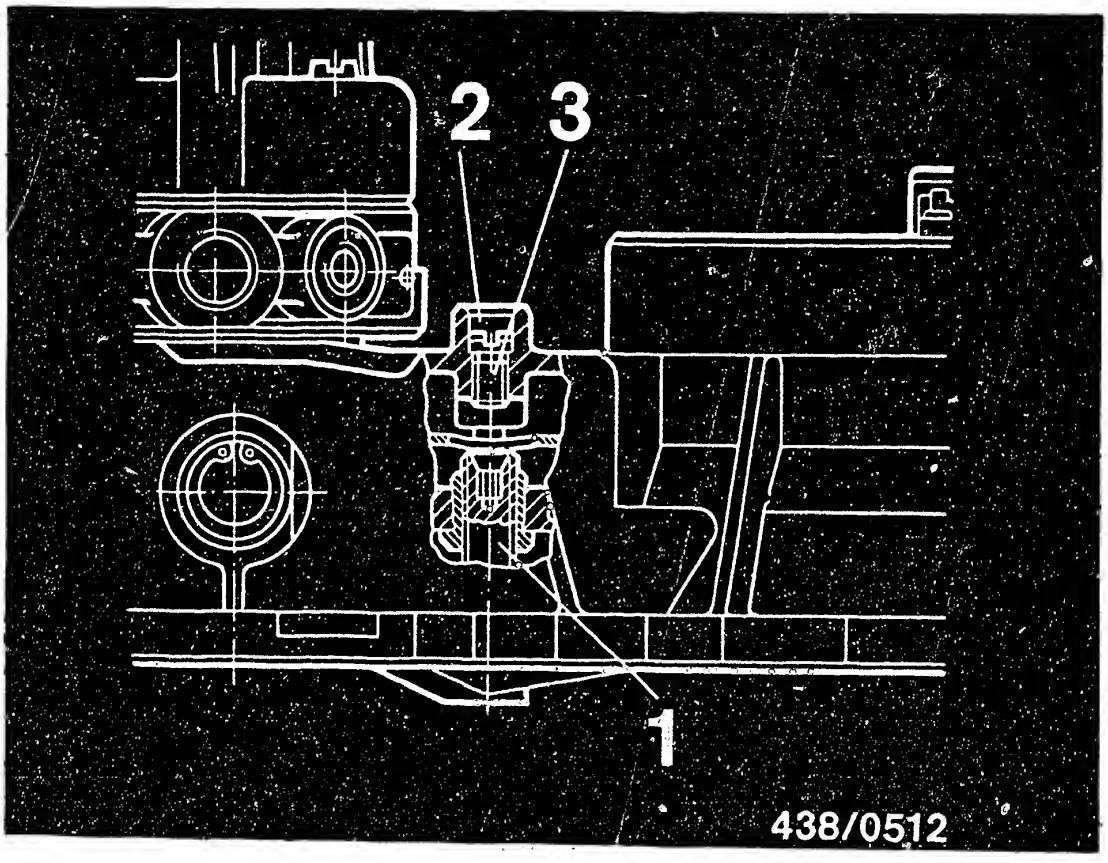


Remove the plunger. Under certain conditions, in order to do this it may be necessary to blow compressed air briefly against the plunger through the control-pressure connection hole. Hold the plunger with your hand while doing this. Clean the plunger thoroughly with benzine. If the plunger still does not move freely, replace the fuel distributor.



9.4 Fitting the fuel distributor

When fitting the fuel distributor, use a new seal ring between fuel distributor and air-flow sensor.
Observe the tightening torque 3.2...3.8 Nm (0.32... 0.38 kgfm) for the fastening screws precisely.
When connecting the fuel-injection tubing, use new seal rings.

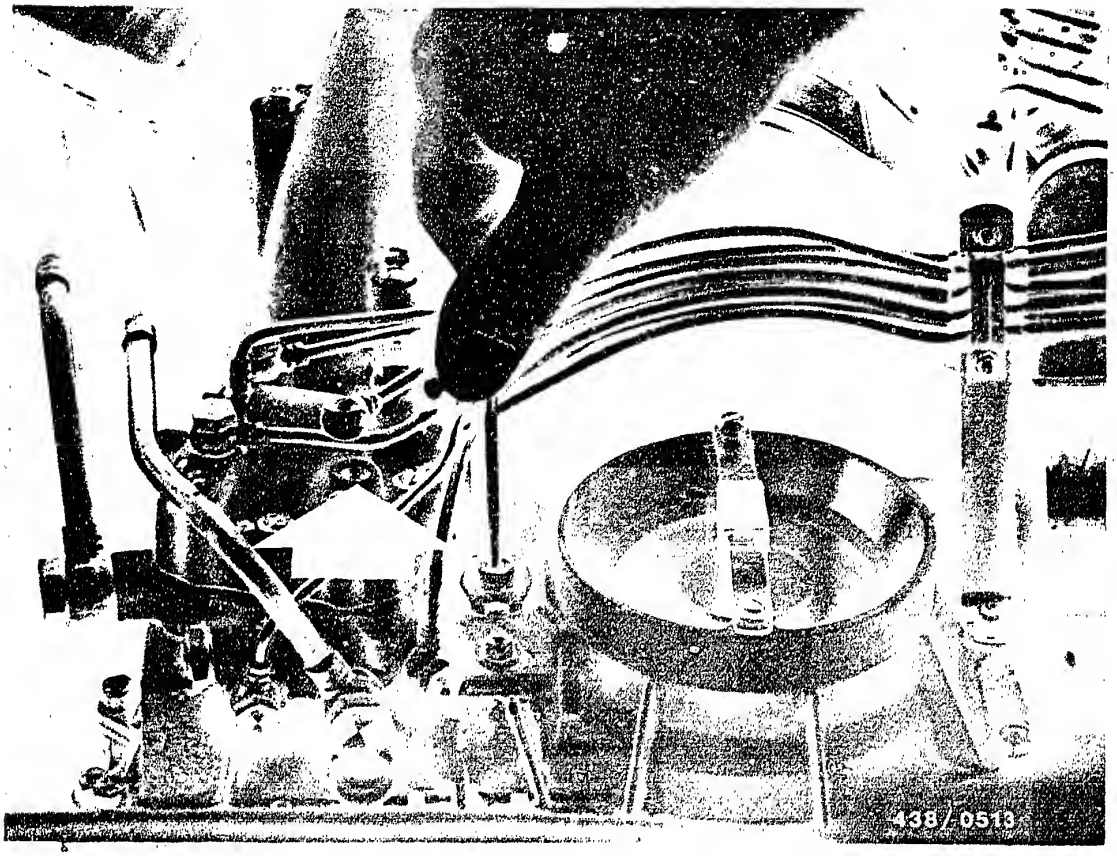


9.5 Matching the fuel distributor to the air-flow sensor for initial starting:

Screw off one fuel-injection line from the fuel distributor.

Remove the anti-tamper device (lead seal). Insert the adjusting wrench KDEP 1035 through the bore into the idle-mixture-adjusting screw.

Bridge the electrical safety circuit so that the electric fuel pump operates.



Screw in the idle-mixture-adjusting screw slowly and without exerting any great pressure on the adjusting wrench until fuel is just delivered from the open outlet (arrow) of the fuel distributor. Then turn back the adjusting screw by 1/2 turn.
Re-connect the fuel-injection line to the fuel distributor, start the engine and warm up.
The final matching of air-flow sensor and fuel distributor is carried out by adjusting the idle speed with the engine at normal operating temperature.
Idle-speed adjustment is described on Coordinates F 8.

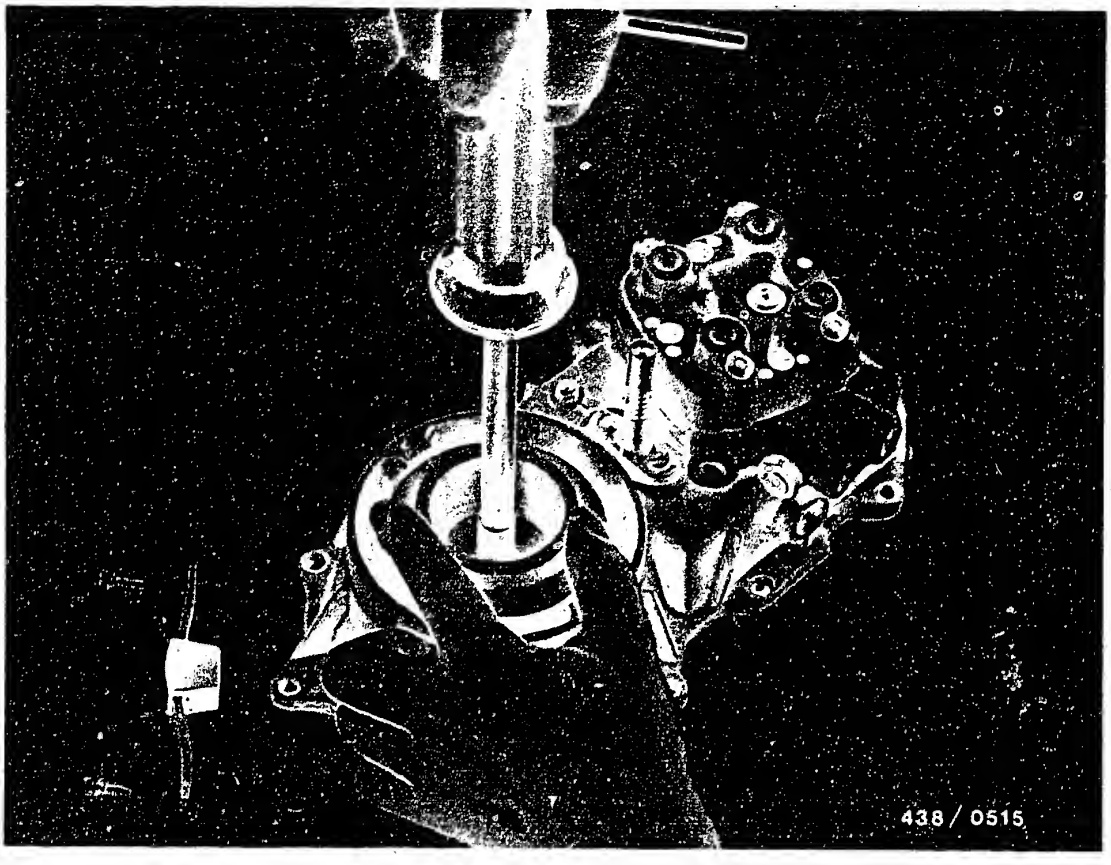
10. Checking and adjusting the position of the air-flow sensor plate

10.1 Preparations

- Engine temperature is not important.
- Remove the rubber hood (release 2 clamping bands), so that the air-flow sensor plate becomes accessible.

10.2 Centering the air-flow sensor plate

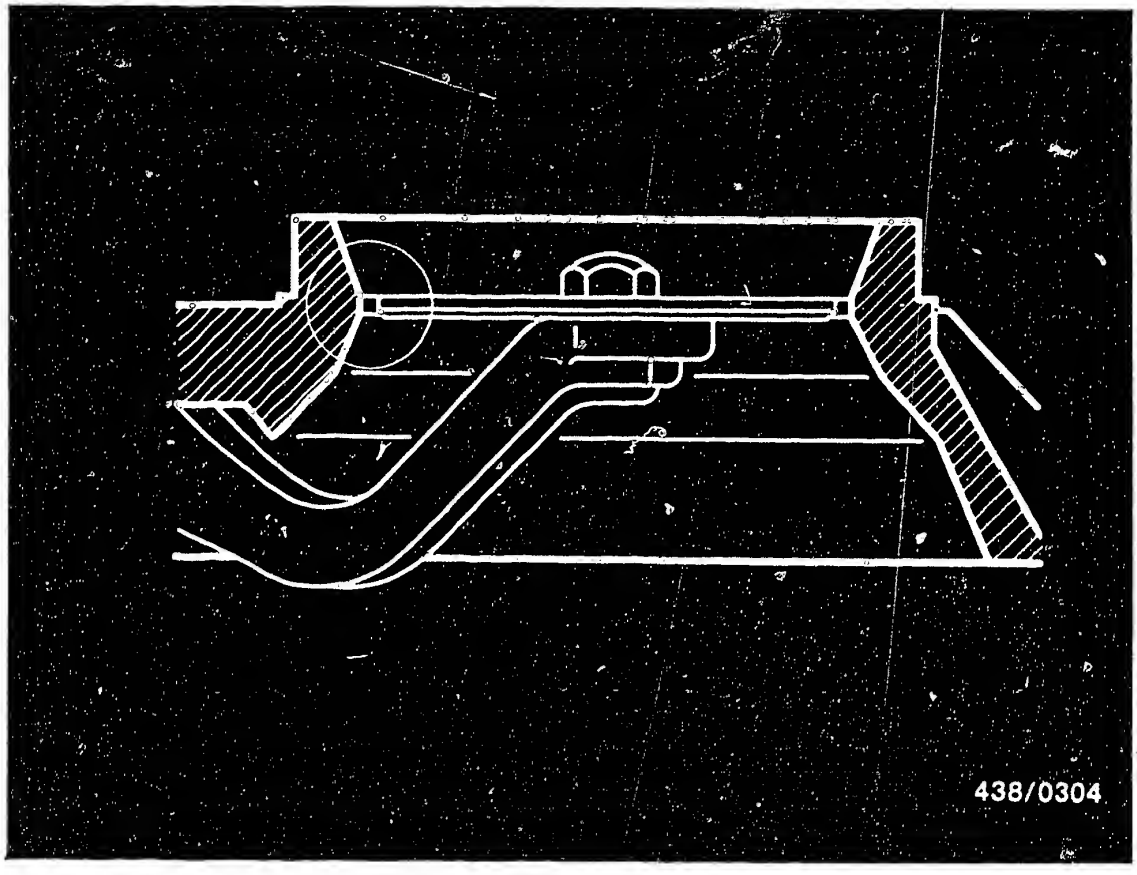
Check that the sensor plate is flat (not bent) and that it can move through the narrowest part of the air funnel without touching the funnel. If necessary, center it using a positioning ring KDEP 1040/12 (dia. 76 mm) as follows:



Remove the stop bracket after loosening the two fastening screws.

Loosen the sensor plate fastening screw. Insert the positioning ring while holding the fastening screws with pliers so that the sensor plate does not deflect downwards.
With the positioning ring in place, tighten the fastening screw with a torque of 5.0...5.5 Nm, loosen again and tighten again with the same torque.

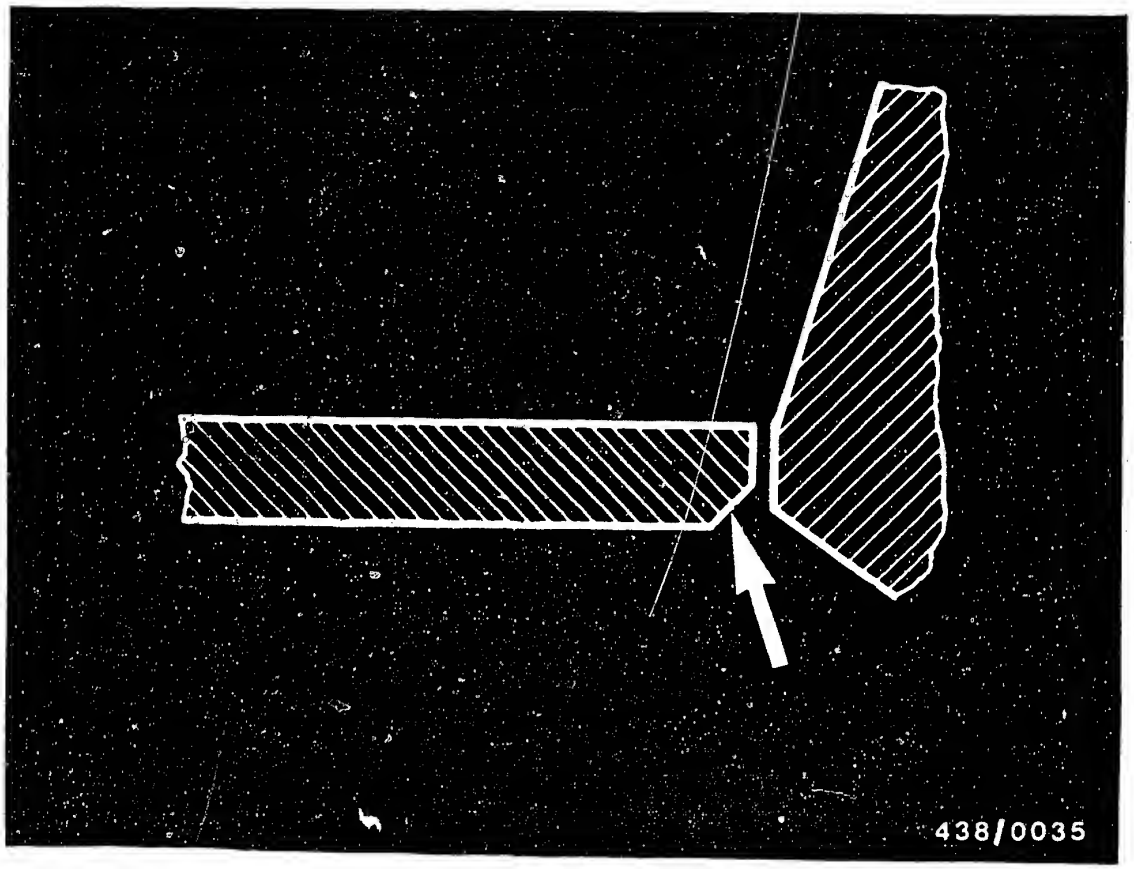
When tightening the screw make sure that the air-flow sensor plate is in its zero position (in the cylindrical part of the air funnel).
It must no longer be possible to turn the air-flow sensor plate by hand.



10.3 Checking and adjusting the zero position of the sensor plate (Rest position):

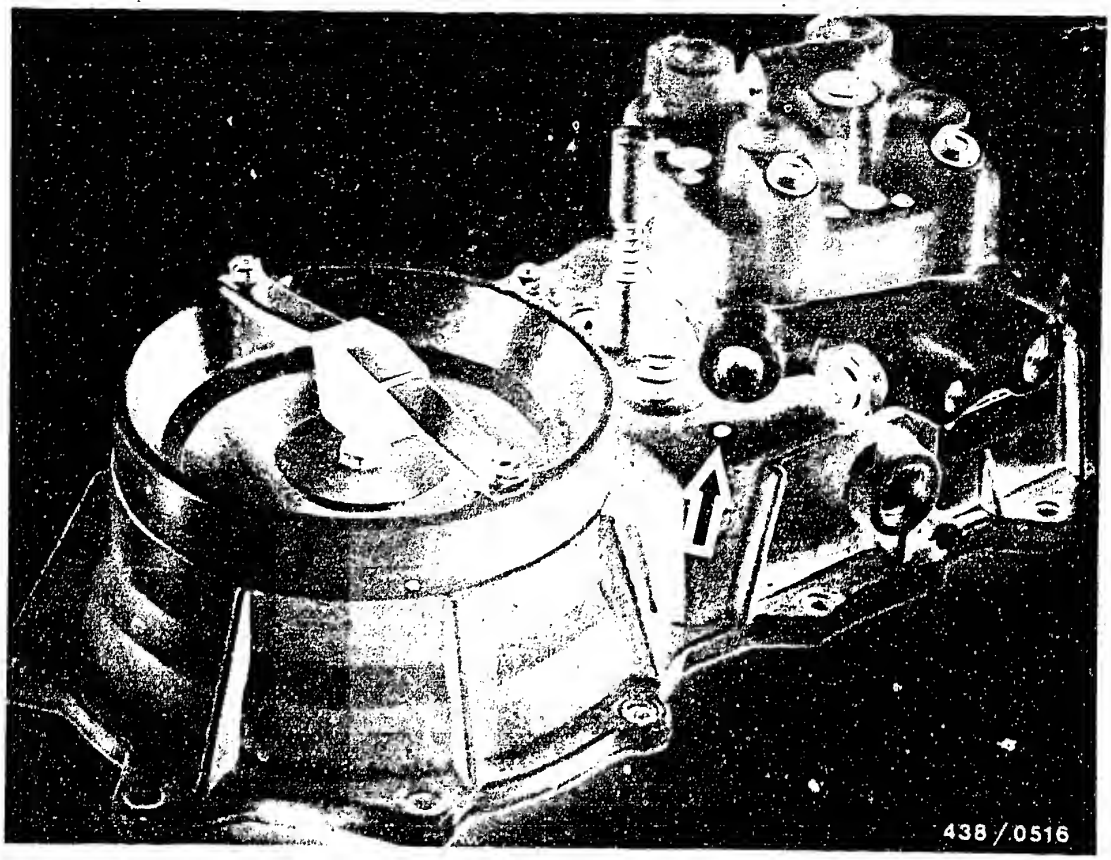
Switch on the electric fuel pump for approx. 10 seconds by bridging the safety circuit.
This results in application of the control pressure to the control plunger in the fuel distributor.

The upper edge of the sensor plate must be flush with the beginning of the cone (relief funnel, top) or max. 0.5 mm higher. The air-flow sensor plate must be flat and must not project at any point on its circumference outside the cylindrical part of the air funnel.



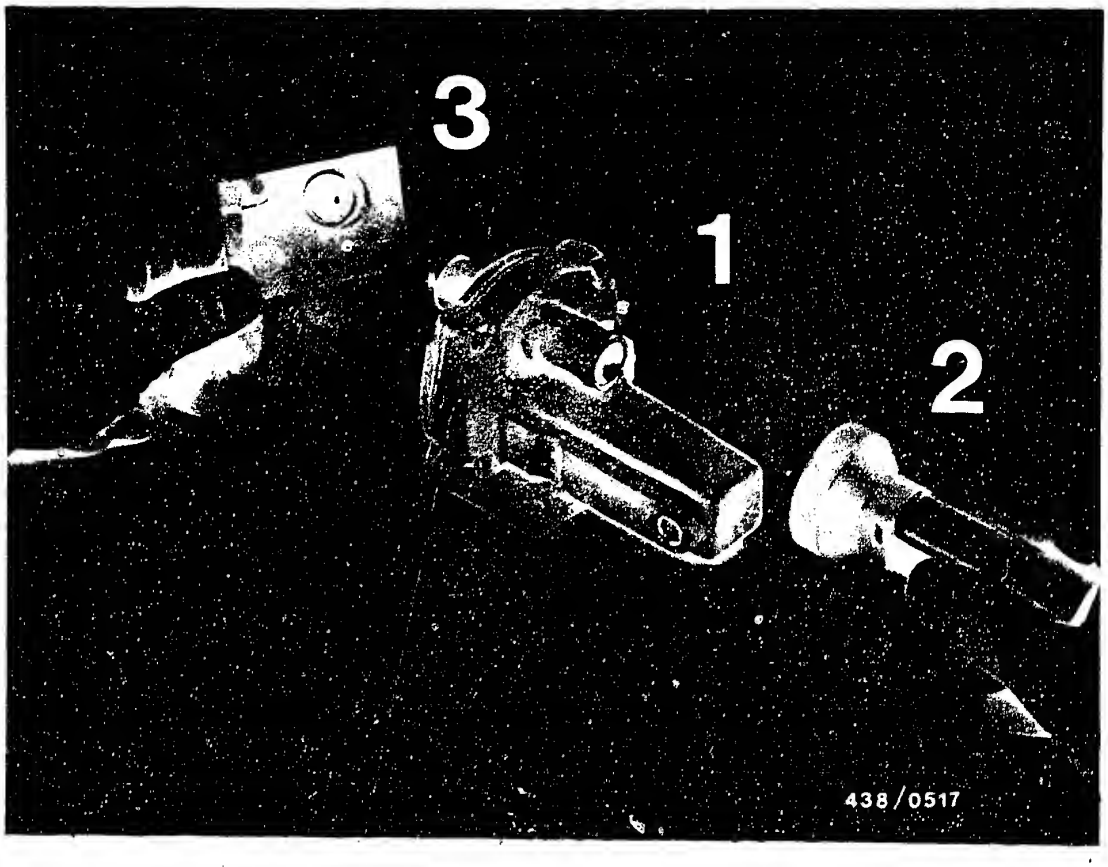
Caution:

The lower edge of the sensor plate is partially chamfered. Be absolutely sure that this chamfered edge is on the bottom (arrow). The upper side of the sensor plate is (in some cases) marked by the work "top".



If the sensor plate is positioned too high, an adjustment can be made. To do this, drive the guide pin (arrow) for the leaf-spring limit-stop deeper using a mandrel and a light hammer.

Caution:
Make this adjustment very carefully so that the guide pin is not driven in too far.
Be absolutely sure to avoid repeated adjustments in both directions because this can loosen the press fit of the pin. Serious engine damage can result if this pin should drop out.



1 = Auxiliary-air device
2 = Flashlight
3 = Mirror

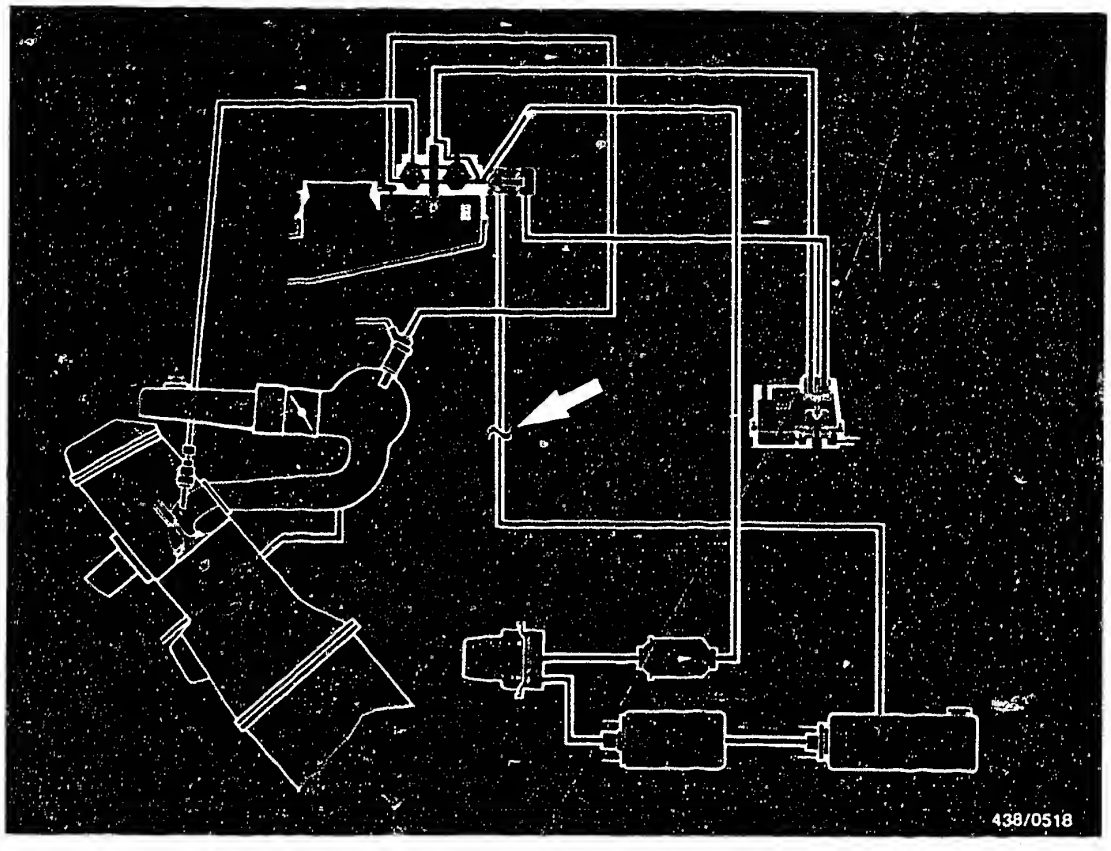
11. Checking the operation of the auxiliary-air device.

The engine must be cold.
Disconnect the electric cable plugs from the auxiliary-air device and warm-up regulator.
Disconnect both air hoses from the auxiliary-air device.
Since the two hose fittings on the auxiliary-air device are located exactly opposite each other, a visual check can now be made to see if the blocking plate is partially open.

It is easier to check the auxiliary-air device with the aid of a flashlight and mirror, as shown in the picture. If, with the engine cold, no opening is visible, replace the auxiliary-air device.
Connect the plug to the auxiliary-air device.
By bridging the electrical safety circuit, establish the power supply to the auxiliary-air device.
After max. 10 minutes the opening in the auxiliary-air device must be closed completely by the blocking plate.
If the blocking plate does not close, check the power supply (open circuit, voltage drop).
Minimum voltage across connector 11.5 V with engine stopped. If these points are O.K., check the heating coil of the auxiliary-air device for an open circuit using an ohmmeter.
Replace the auxiliary-air device if defective.

When the auxiliary-air device has been replaced, carry out the idle adjustment with the engine at normal operating temperature.

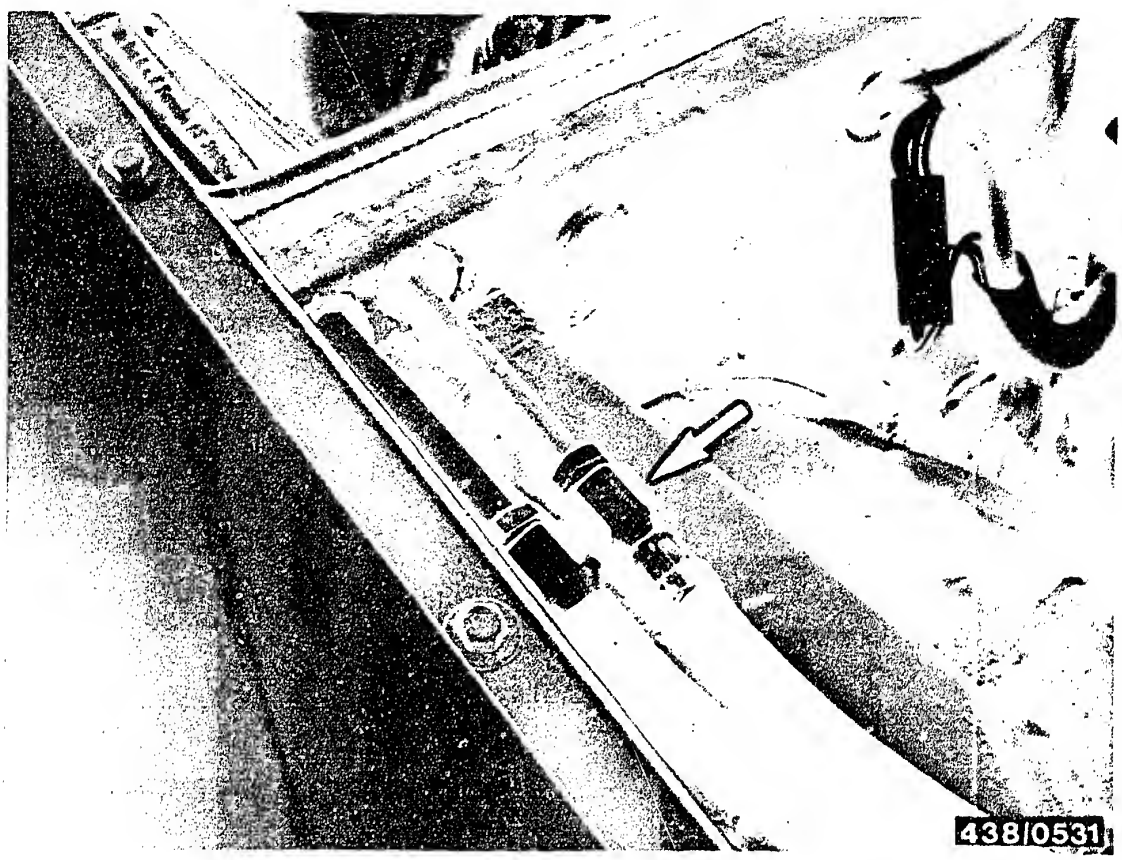
Idle adjustment is described on Coordinate F 8.



12. Checking the operation of the electric fuel pump.

12.1 Requirement

Conclusive information on the operation of the electric fuel pump can only be given by a measurement of fuel delivery under pressure, i.e. under primary (system) pressure. This measurement must therefore be made at the return line leading to the fuel tank (arrow).



12.2 Measuring point

A suitable measuring point for testing the fuel delivery is the fuel return line to the fuel tank. Undo the connector (arrow) and hold the hose (from the fuel distributor) in a graduate (1.5 litres capacity) in order to make the measurement.

Since the measurement is performed with the engine stopped, switch on the electric fuel pump while measuring by bridging the electrical safety circuit.

12.3 Test specification:

Fuel delivery min. 1050 cm^3/30 seconds.

12.4 Possible causes of fuel delivery being too low:

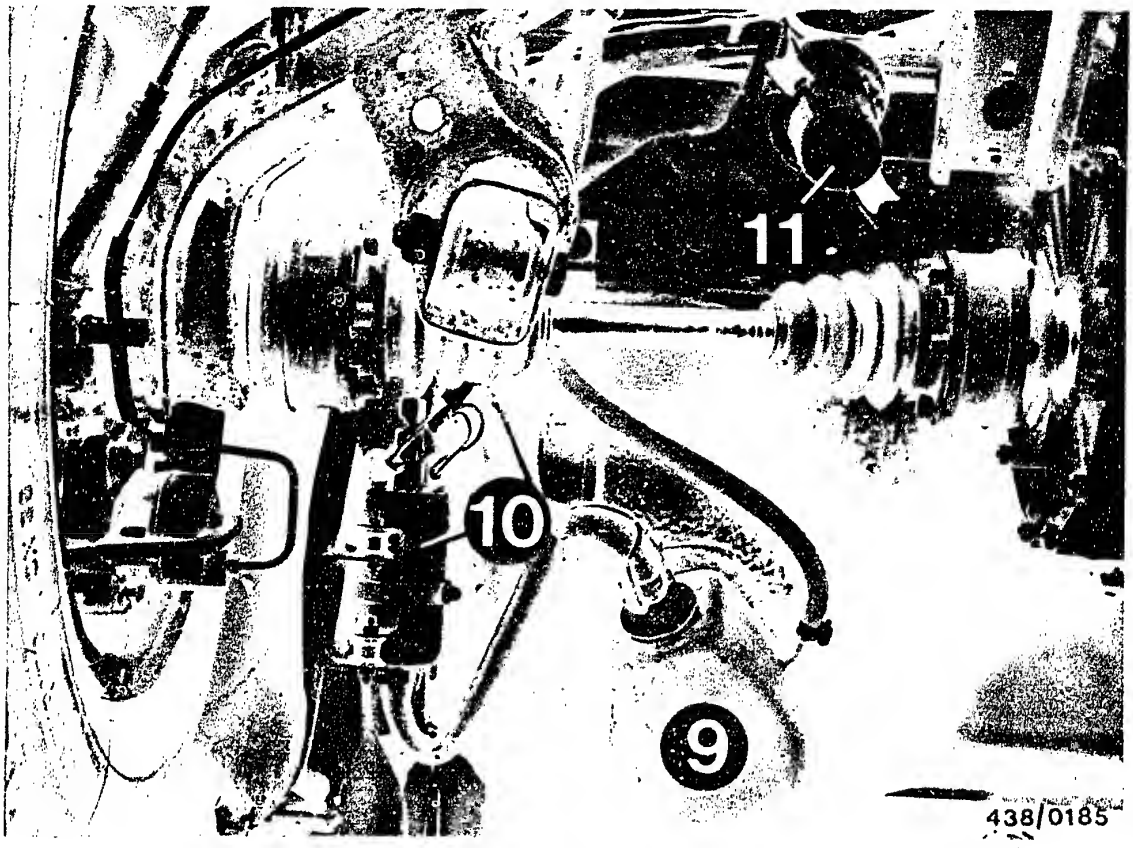
- Power supply to electric fuel pump not O.K.. Voltage drop across terminal of electric fuel pump. Minimum voltage with pump operating 11.5 V.

- Fuel filter heavily fouled.

- Pre-supply pump not operating.
  Test by listening, possibly with the main electric fuel pump disconnected.

  Note:
  There is a prefilter on the intake side of the pre-supply pump. This filter cannot be replaced separately. Should it be the cause of the fuel delivery being too low, the complete pre-supply pump must be replaced.

  If all the above-mentioned points are O.K., replace the electric fuel pump.



9 = Electric pre-supply pump (not made by Bosch)
10 = Electric fuel pump
11 = Fuel accumulator

12.5 Removal and installation of the fuel pumps:

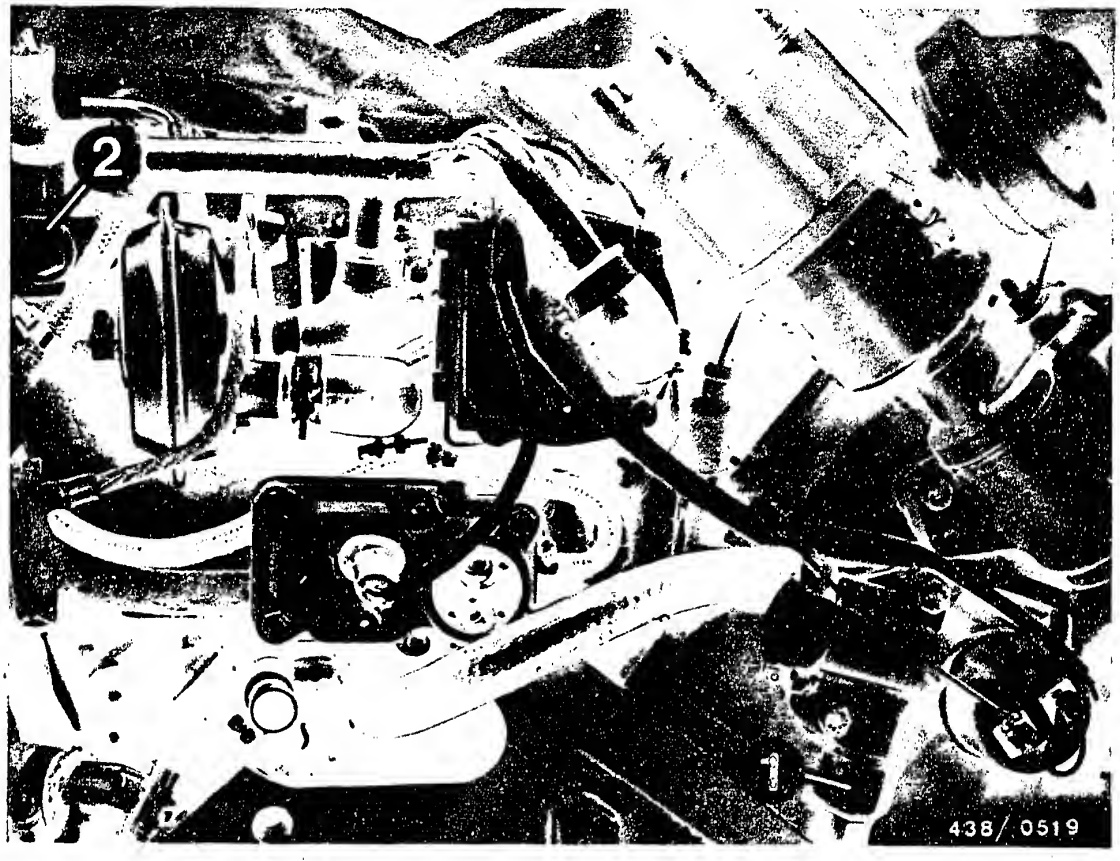
Electric fuel pump:
Before loosening the intake hose line, pinch off (e.g. using Matra hose clamper W 157).

Pre-supply pump with prefilter:
Drain the fuel tank before removing the pre-supply pump. Since there is no drain plug on the tank, the fuel must be pumped out through the filler neck using a suitable suction pump.

Remove the electrical connections from the pre-supply pump.

Pinch off the hose line to the electric fuel pump (e.g. using hose clamper W 157 from Matra Co.).
Loosen the hose clamp on the pre-supply pump and remove the hose.
Unscrew the pre-supply pump from the fuel tank.

Caution: Collect any escaping fuel. Install the new pump with a new seal.

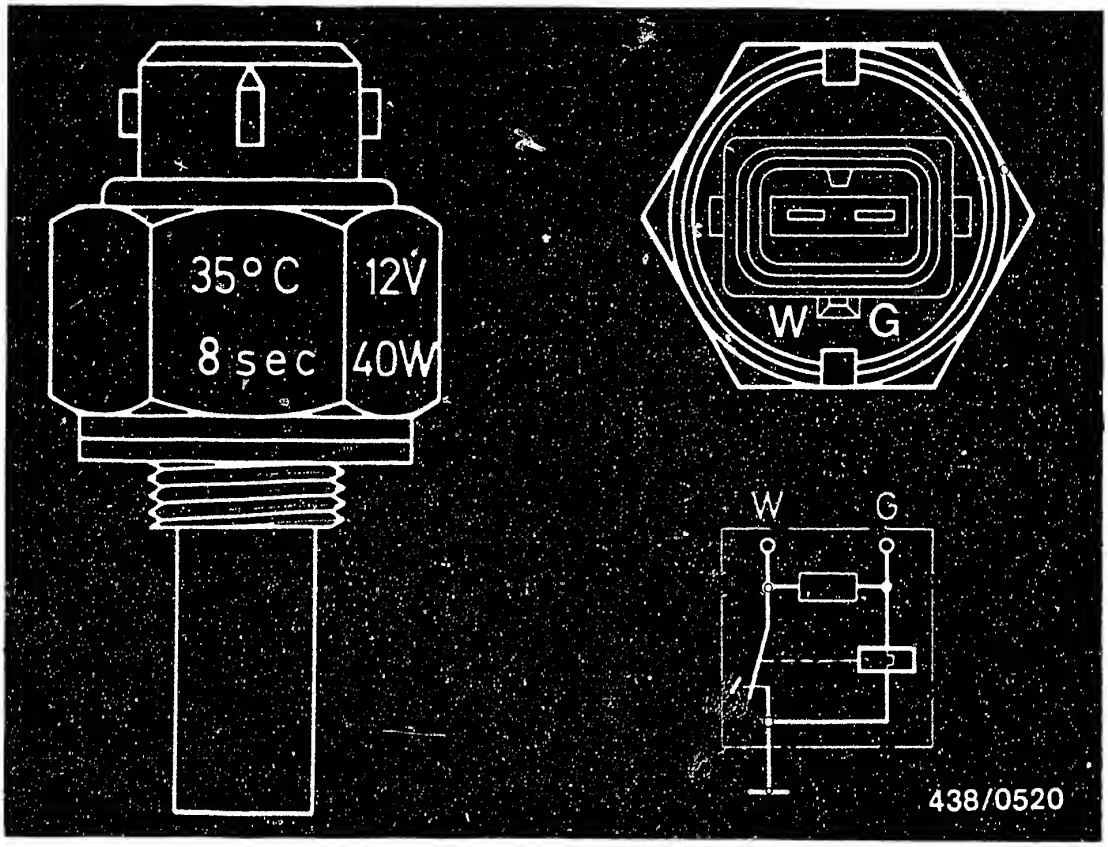


1 = Thermo-time switch 2 = Start valve

13. Checking the cold-starting system (thermo-time switch, start valve).

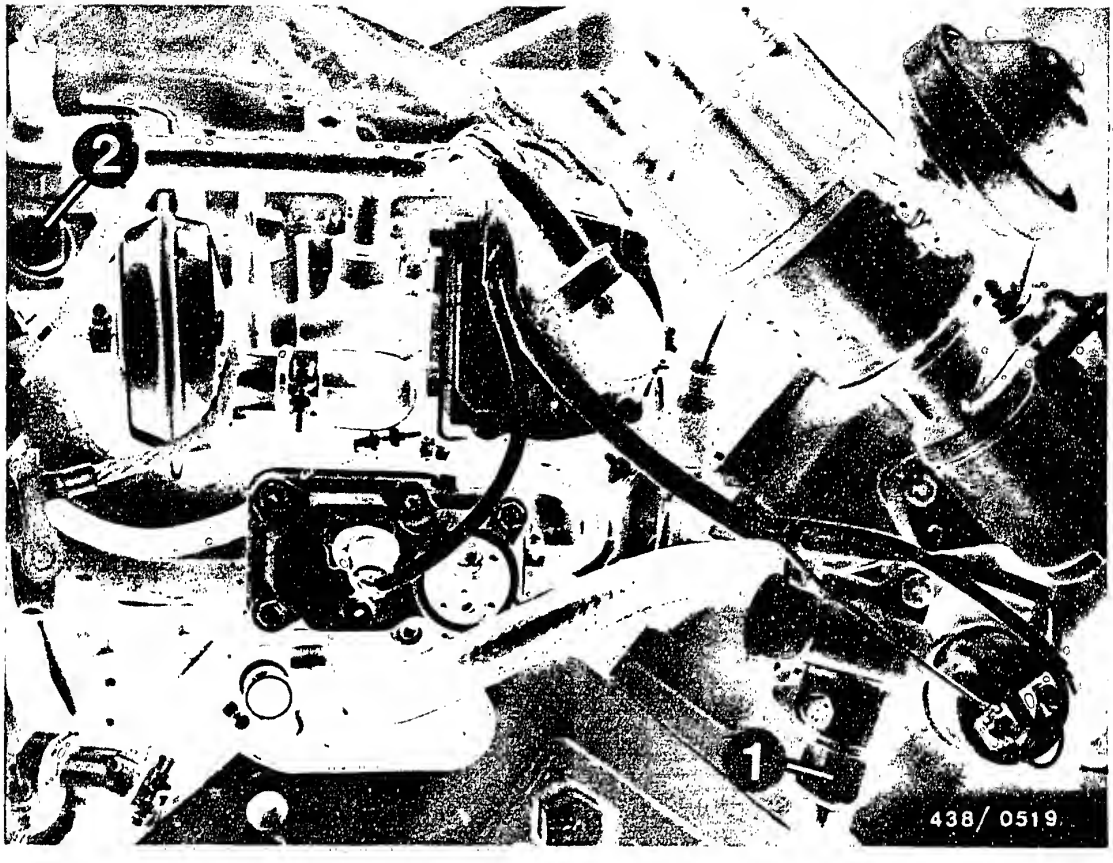
13.1 Thermo-time switch:

Remove the thermo-time switch for testing. It is located on the rear end face of the cylinder head in the cooling-water distributor fitting (not visible from above, shown in the picture from underneath the vehicle). The thermo-time switch is best removed from below. Caution: If possible, remove only with the engine cold since some cooling water will escape. The quantity of cooling water escaping would be considerably greater if the engine were hot.



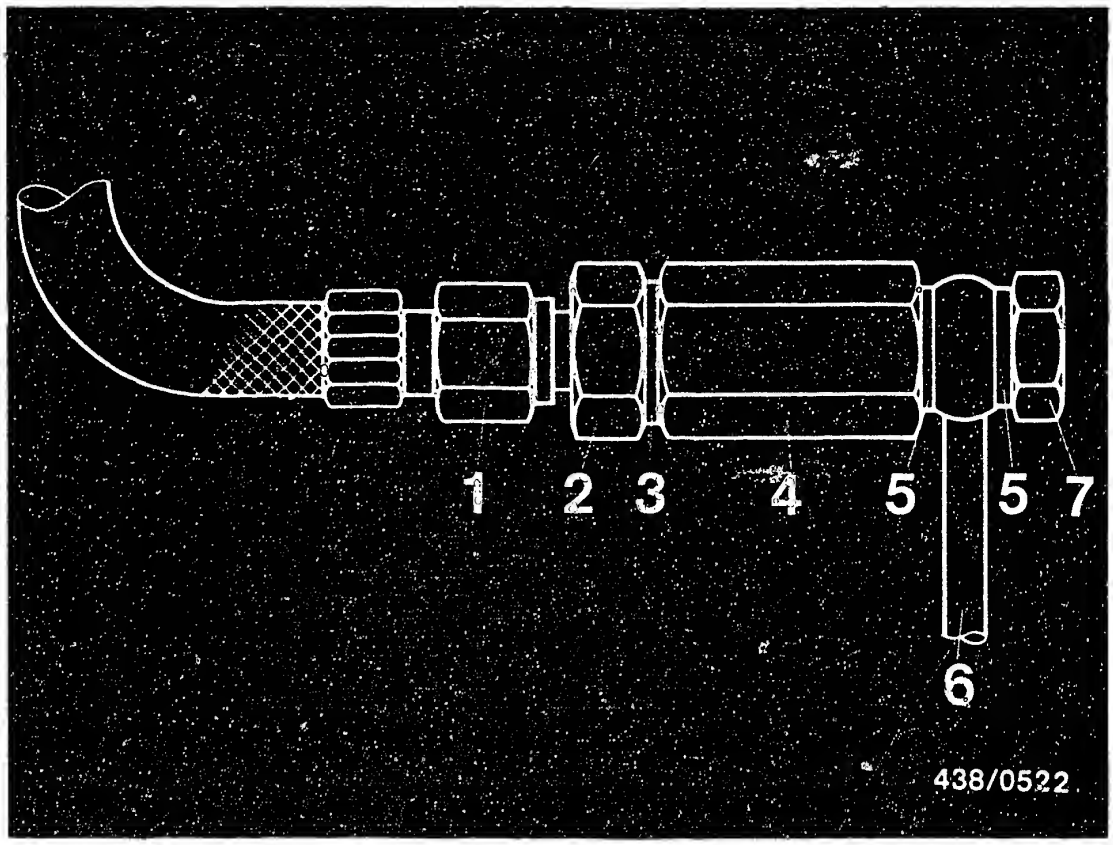
The thermo-time switch used in the Porsche 924 Turbo-Carrera has a switching temperature of 35°C and a switching time at -20°C of 8 seconds. Both values are stamped into the hexagonal section of the thermo-time switch.
The removed thermo-time switch is tested using the ohm-meter in accordance with the specifications given below. The temperatures for the thermo-time switch can easily be obtained with water.

At a temperature below °C	above °C	Resistance measurement (Ω) between Term. "G" and "ground" (housing)	Term."W" and "ground" (housing)	Term. "G" and term. "W"
+ 30		25...40	0	25...40
	+40	50...80	100...160	50...80



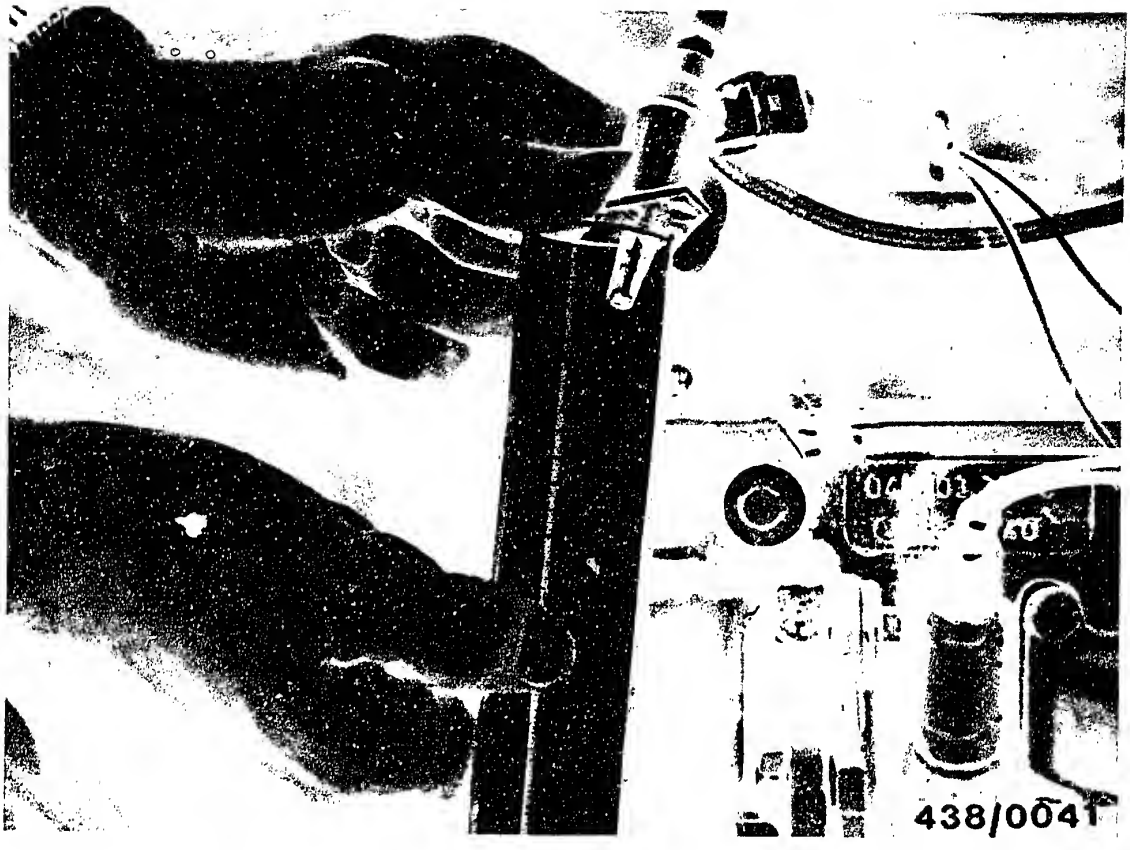
13.2 Start valve:

To make the start valve (2) more easily accessible, it is a good idea to remove the ignition coil first. Remove the electric connector from the valve. Unscrew the fuel supply line from the valve (steel line) and remove the valve.
Re-connect the fuel supply line to the valve via a flexible hose line as follows:



1 = Hose line of pressure tester KDJE-P100
2 = Double threaded fitting 2 x M12x1.5, 1x60° internal taper
3 = Seal ring
4 = Adapter from connecting-parts set KDJE-P100/10
5 = Seal rings
6 = Fuel line
7 = Original inlet-union screw

Connect the hose line with the original inlet-union screw to the adapter from connecting-parts set KDJE-P100/10 (previously KDEP 1034/10). Screw a commercially available double fitting 2xM12x1.5 into the adapter. Connect a hose line of the pressure tester KDJE-P100 (previously KDEP 1034) to the double fitting.



Using connecting piece M12x1.5/M8x1 from the connecting-parts set, connect the start valve to the hose line. Connect the start valve directly to ground and terminal 15 (e.g. on the ignition coil) using the connecting cable KDJE 7450/70.

Important note: During this test, do not let the connecting cable touch B+. Danger of fire due to sparking!
Hold the start valve in a suitable container (e.g. graduate).
Switch on the electric fuel pump by bridging the safety circuit.
Switch on the ignition (max. 30 seconds). The start valve must now open and spray fuel.

Switch off the ignition, remove the electric connecting cable and dry the nozzle of the start valve.

The safety circuit remains bridged so that the primary pressure is applied to the start valve.

No droplets of fuel must drip from the nozzle of the start valve during the next minute. Even if shaken and knocked, the start valve must not leak.

Then switch the electric fuel pump off again.
Replace the start valve if it does not open or if it leaks.

If a leaky start valve or a defective thermo-time switch has been replaced, it is necessary finally to adjust the idle speed with the engine at normal operating temperature.
Idle-speed adjustment is described on Coordinates F 8.

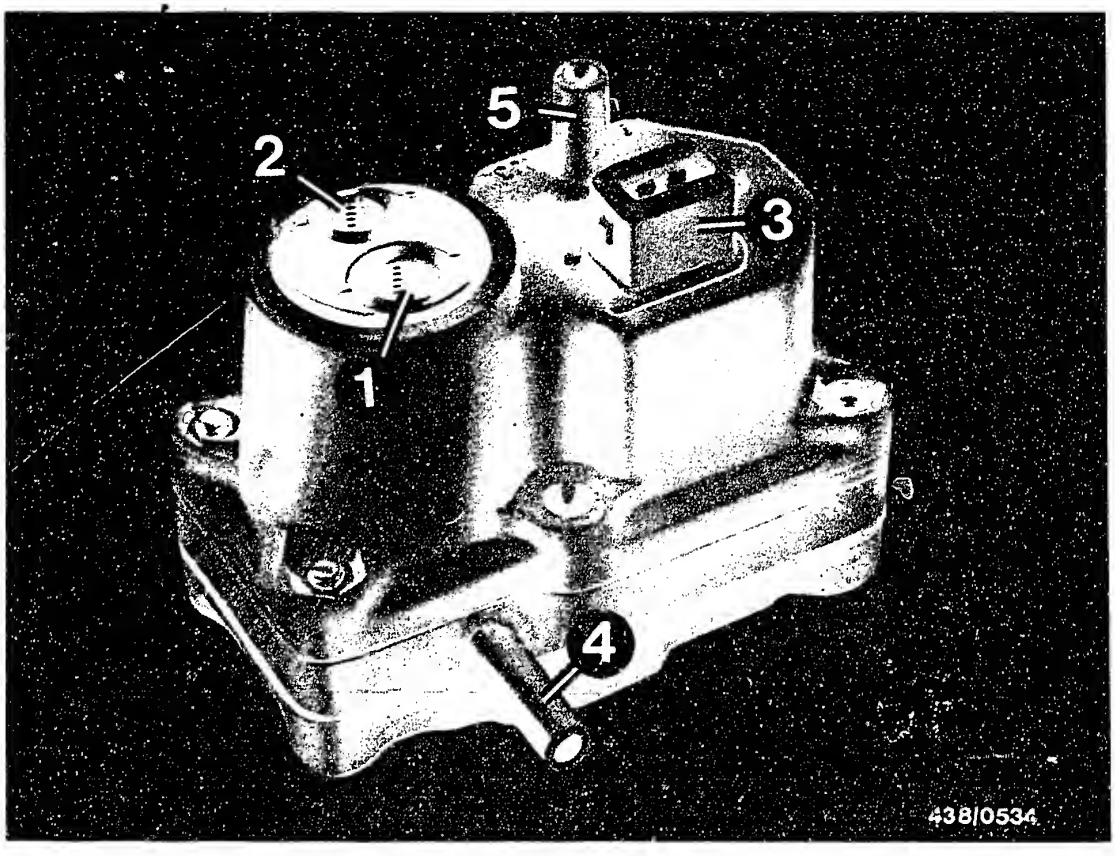
14. Checking the control pressures

14.1 Preliminary remarks:

The control pressures tested in the following are in each case governed by the warm-up regulator.
If the test results are incorrect, however, this may also be due to faults which have nothing to do with the warm-up regulator.

These possible faults are:

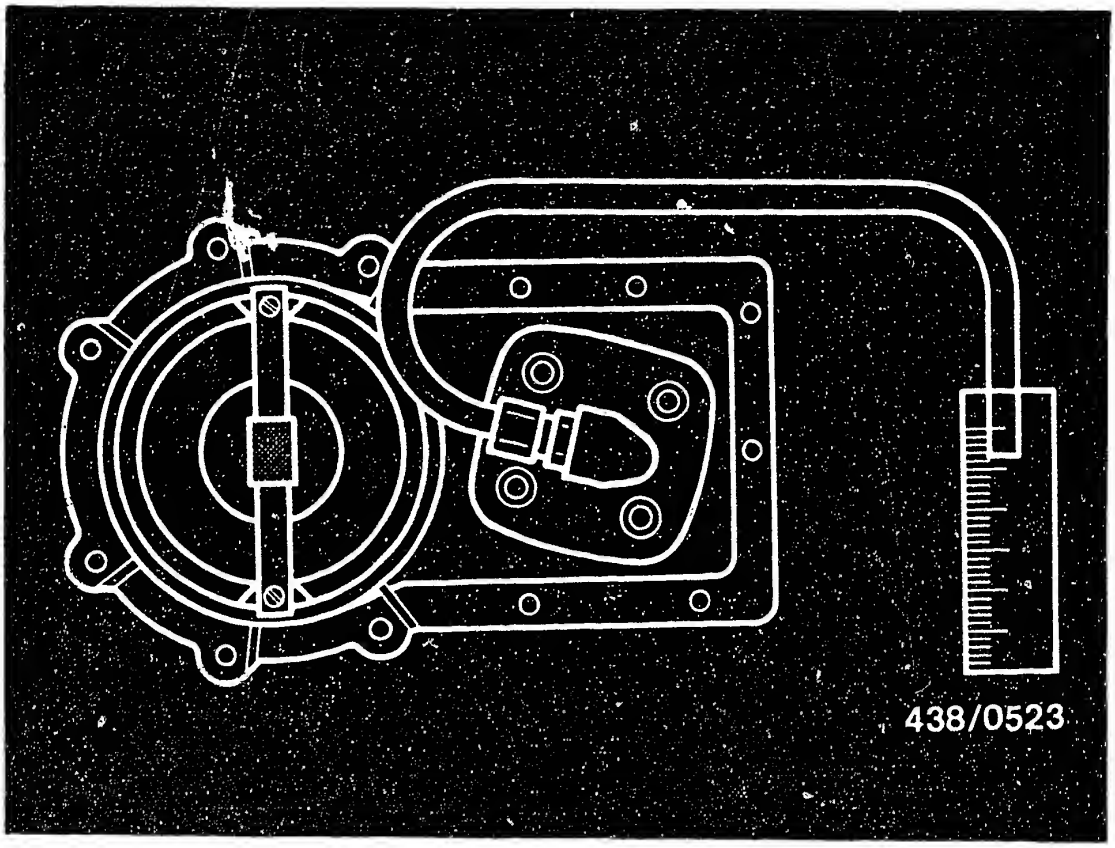
- No or too low a voltage at the electric connector.
- Fuel return from the warm-up regulator blocked or constricted.
- Too high a fuel delivery for the control-pressure circuit.
  The testing of this control-pressure delivery is described as an additional test step at the beginning of the control pressure tests.
  Reference is made to the other possible causes of trouble in the respective test step.



1 = Fuel inlet
2 = Fuel return
3 = Electric connection
4 = Intake-manifold-pressure connection (after throttle valve)
5 = Atmospheric pressure connection (connection between air-flow sensor and throttle valve)

14.2 Version of warm-up regulator:

The warm-up regulator is a version for charge-air-pressure-dependent full-load enrichment.
The operation of this warm-up regulator is basically the same as that of the known version for intake-manifold-pressure-controlled full-load enrichment.



However, enrichment (control-pressure reduction) does not take place during normal (naturally aspirated) engine operation, but only when there is charge-air pressure (gauge pressure) in the intake manifold.

14.3 Checking the fuel delivery for the control-pressure circuit:

Test requirements: The electric fuel pump must be operating properly.
Test specification: Delivery min. 1050 cm^3/30 seconds.

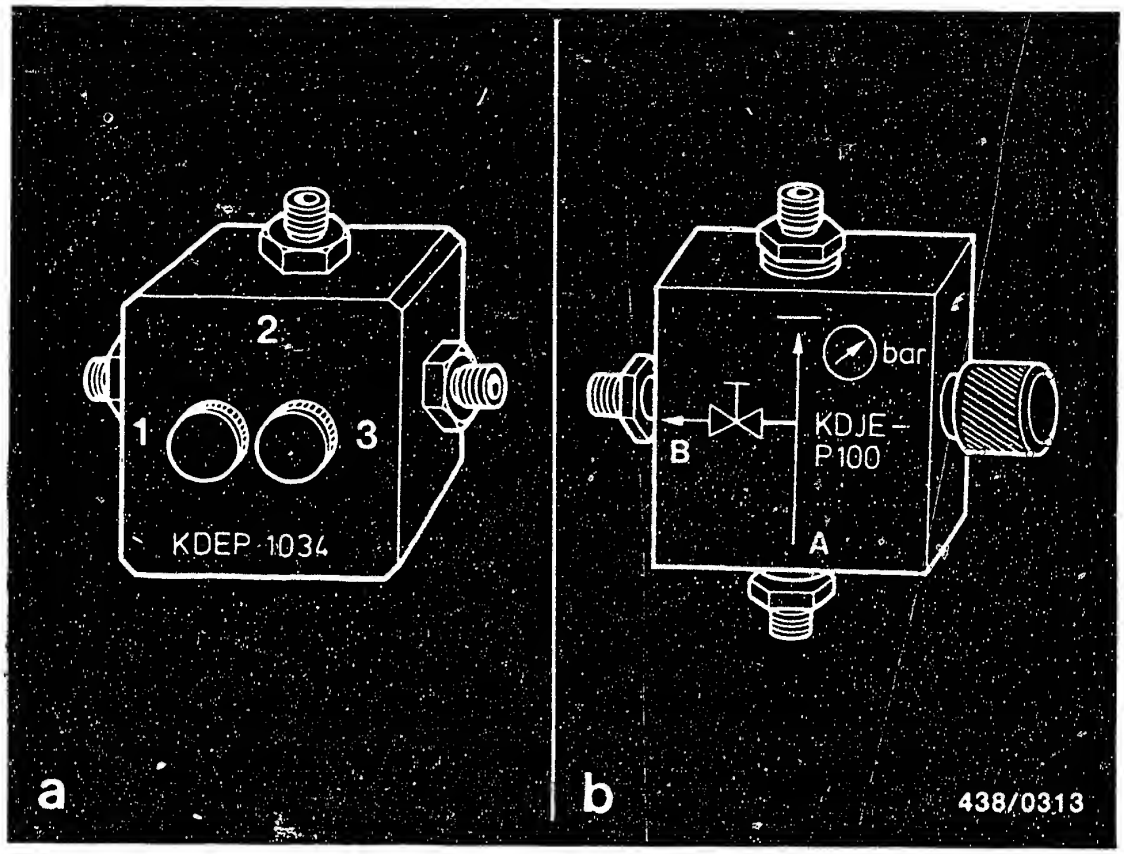
Unscrew the control-pressure line (to the warm-up regulator) from the fuel distributor and screw connecting piece (thread M 8x1/M 12x1.5) from connecting-parts set KDJE-P 100/10 into the control-pressure connection port.

Connect one of the two hose lines of pressure tester KDJE-P 100 (previously KDEP 1034) to the control-pressure connection port on the fuel distributor (thread M 12 x 1.5) and hold in a graduate (approx. 0.5 litres capacity).

Switch on the electric fuel pump for precisely 1 minute by bridging the electrical safety circuit and measure the fuel delivery.

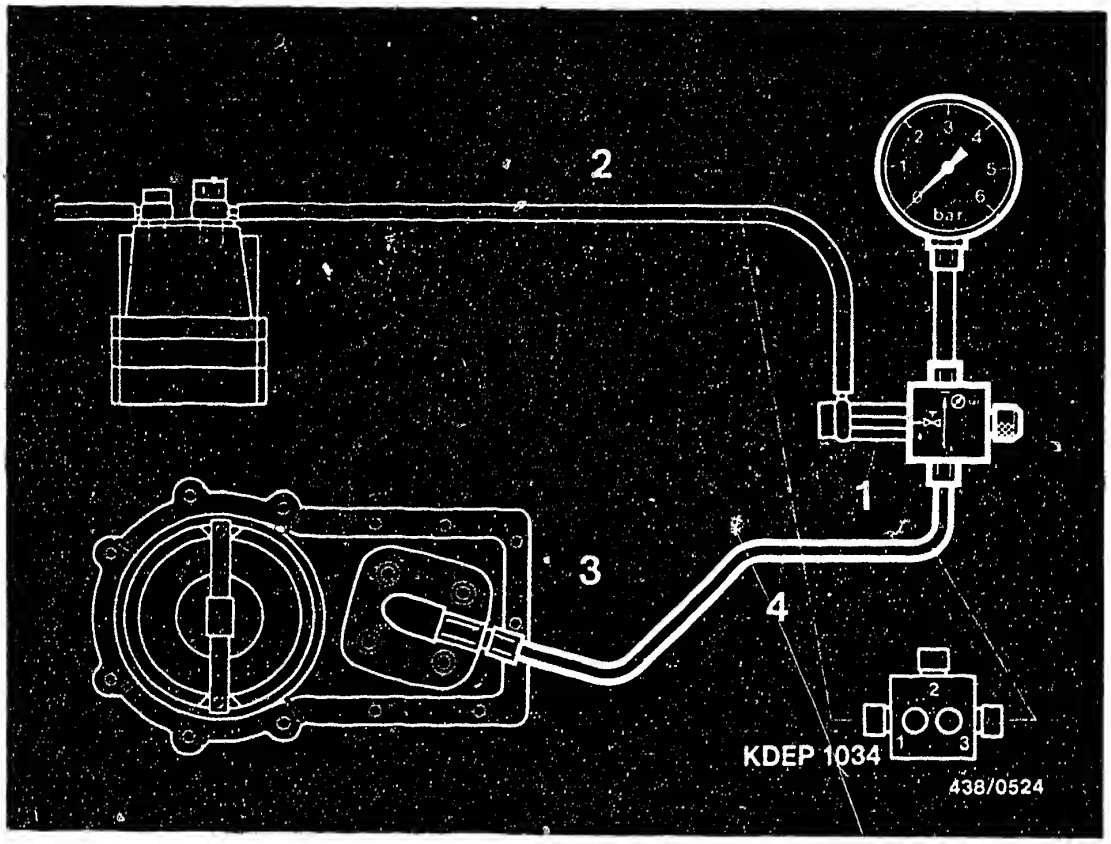
Test specification: 160...240 cm^3/1 Minute.

If the measured value is outside tolerance, the fault lies in the fuel distributor. Therefore, replace the fuel distributor.

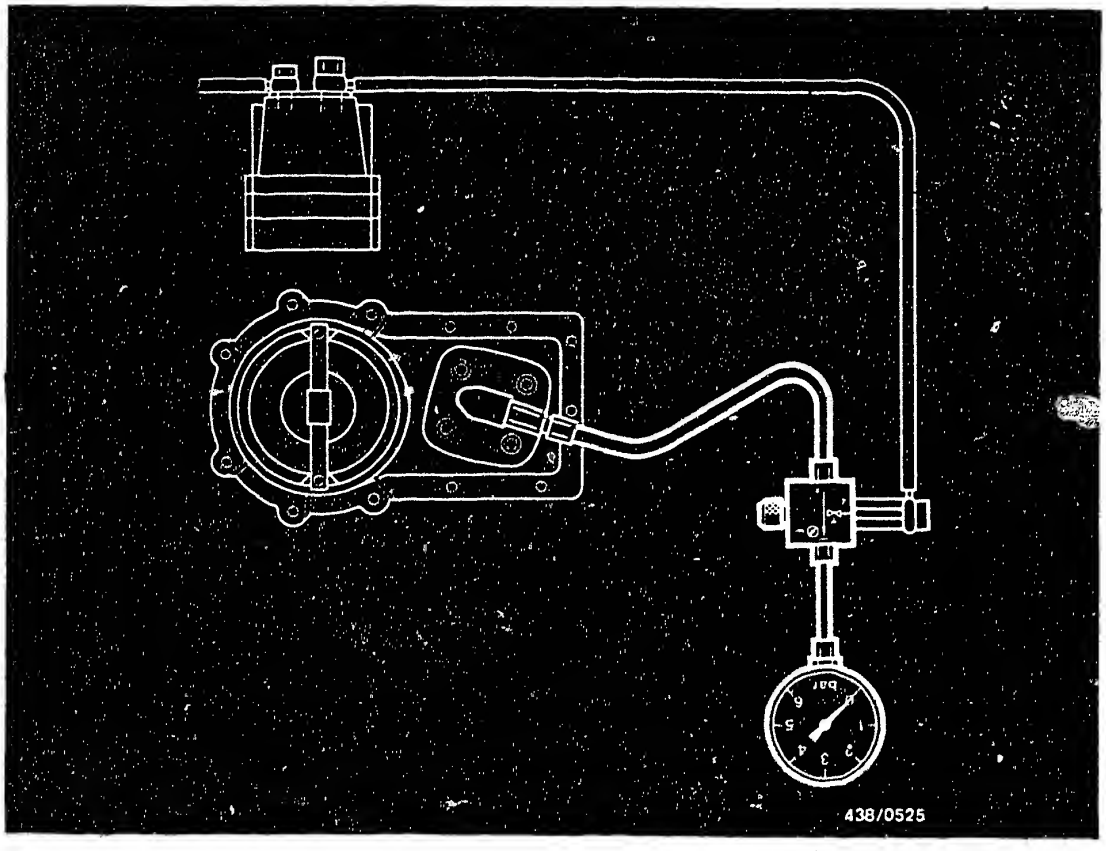


14.4 Mounting the pressure tester KDJE-P 100 (formerly KDEP 1034):

The pressure tester KDEP 1034 is equipped with a three-way valve with 2 separate valve screws. The connections of the directional-control valve are numbered (Fig. a). Since the end of 1979 the pressure tester KDJE-P 100 has been supplied. Its directional-control valve has only one valve screw (Fig. b). The connections of this directional control valve are identified by symbols:
A = Inlet (from the fuel distributor)
B = Outlet (to the warm-up regulator)
Caution:
When the directional-control valve is not in use, always keep the valve screw(s) open in order to relieve the pressure on the seal rings.

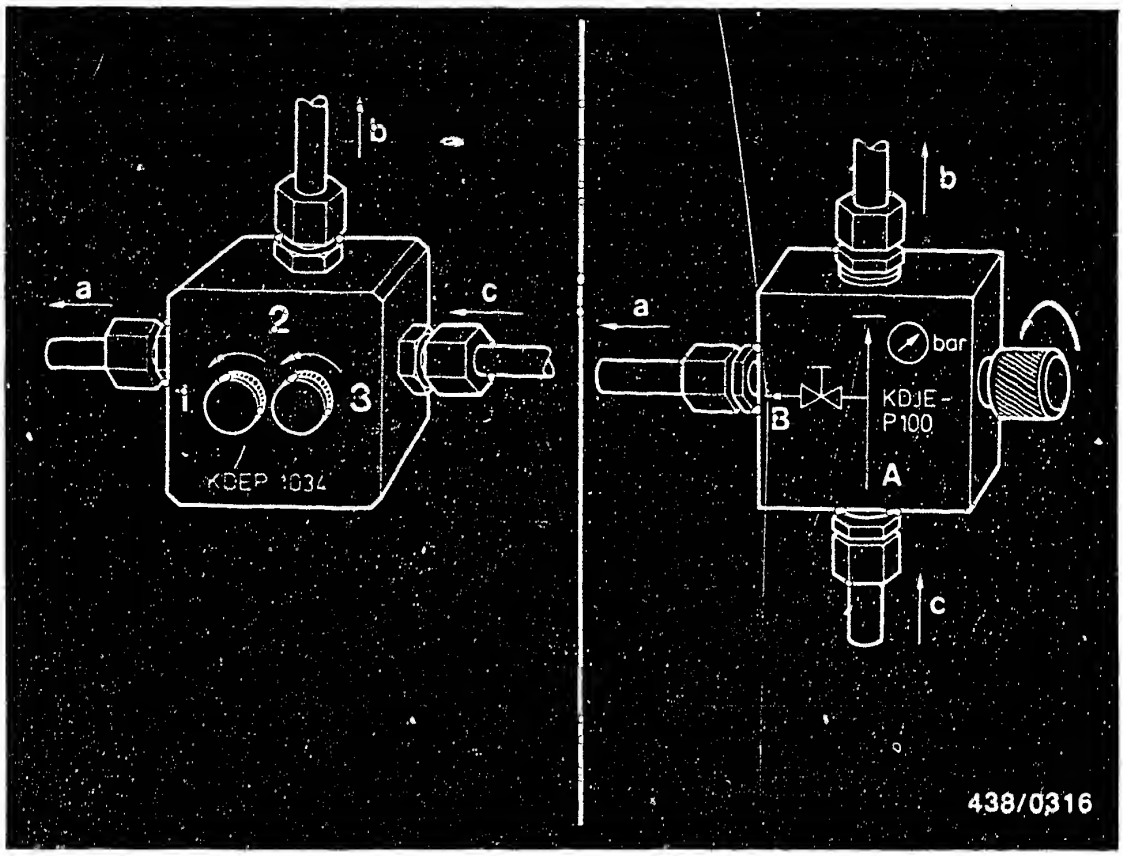


The directional-control valve of the pressure tester is connected into the control-pressure line from the fuel distributor to the warm-up regulator.
Fit using connecting-parts set KDJE-P 100/10.
Screw the adapter of the connecting-parts set with a seal ring onto connection B or 1 of the directional-control valve (1).
Unscrew the control-pressure line (to the warm-up regulator) from the fuel distributor and connect to the adapter (2).
Screw the connecting piece of the connecting-parts set into the control-pressure connection port of the fuel distributor (3) and connect to connection A or 3 of the directional-control valve using hose line (4).



14.5 Bleeding the pressure tester:

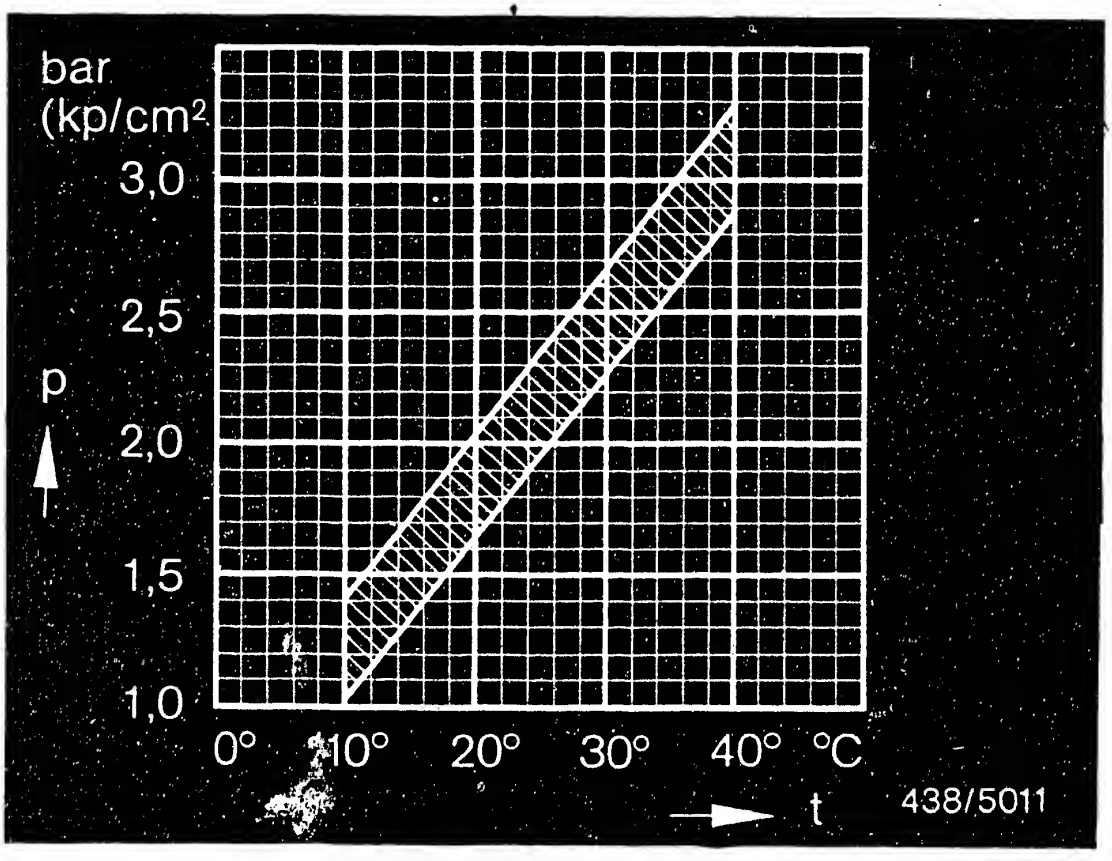
Disconnect the electric plug from the warm-up regulator and the auxiliary-air device.
Let the pressure gauge hang down (hose fully extended).
Switch on the electric fuel pump by bridging the electrical safety circuit:
Open and close the valve screw of the directional-control valve (valve screw 1 in the case of KDEP 1034) in a 10-second rhythm about 5 times. Then hang the pressure gauge from a suitable support (e.g. from one of the struts under the engine hood).
Open valve screw of directional-control valve (both screws in the case of KDEP 1034) (turning to the left).



a = To warm-up regulator
b = To pressure gauge
c = From fuel distributor

14.6 Testing the "cold" control pressure:

The test is performed with the engine switched off. The engine must be cold. For this purpose, the engine should have been switched off for several hours, preferably overnight.
Open the valve screw of the directional-control valve (both screws in the case of KDEP 1034). Switch on the electric fuel pump by bridging the electrical safety circuit:
The pressure gauge now indicates the "cold" control pressure.



p = Control pressure (bar or kgf/cm² gauge pressure)
t = Ambient temperature (°C)

Warm-up regulator Part No.: 0 438 140 054

Calculate the nominal control pressure in accordance with the ambient temperatures in the graph.

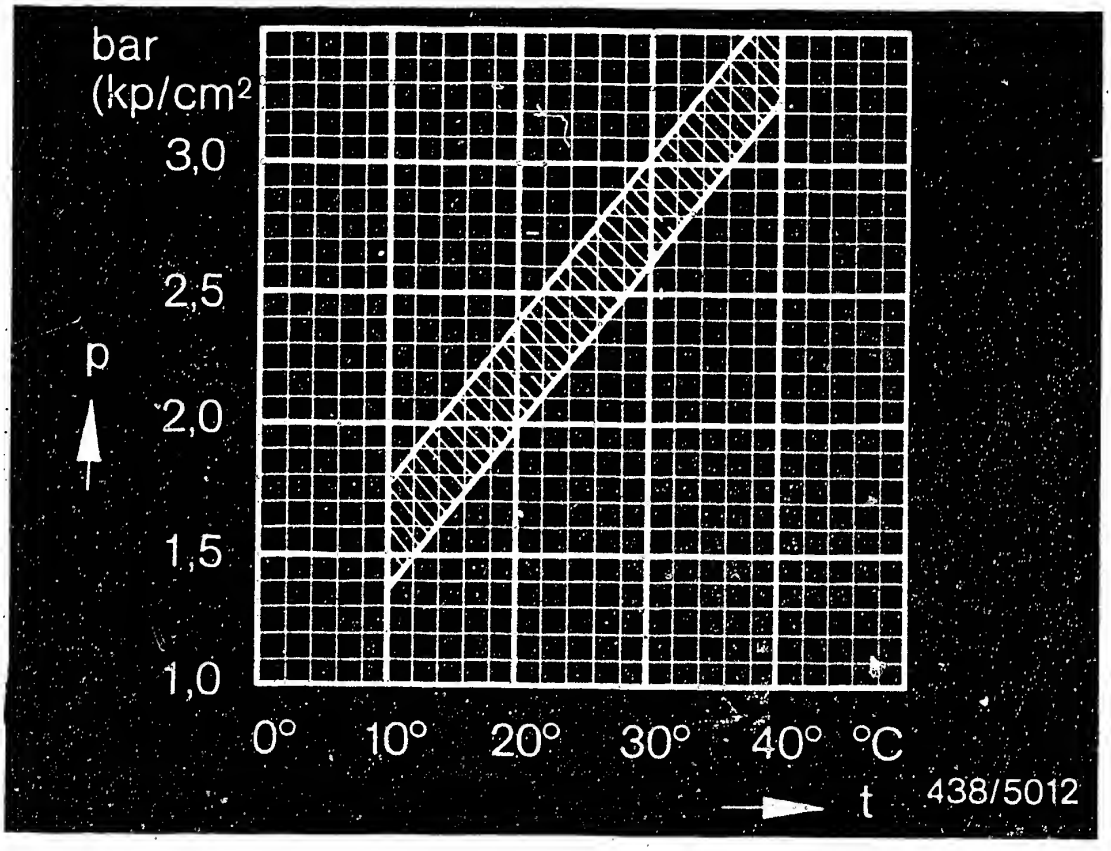
Example: Ambient temperature = 15°C
Nominal control pressure = 1.3...1.7 bar gauge pressure

If the measured "cold" control pressure differs from the test specification, this may be due to one of the following faults:

- Fuel delivery for the control-pressure circuit too low or too high. Test the fuel delivery.
  Test specification = 160...240 cm^3/min.

- Fuel return from the warm-up regulator blocked or constricted (if control pressure too high).
  Eliminate constriction.

- Warm-up regulator defective. Replace warm-up regulator.



p = Control pressure (bar or kgf/cm² gauge pressure)
t = Ambient temperature (°C)

Warm-up regulator Part No.: 0 438 140 062

Calculate the nominal control pressure in accordance with the ambient temperatures in the graph.

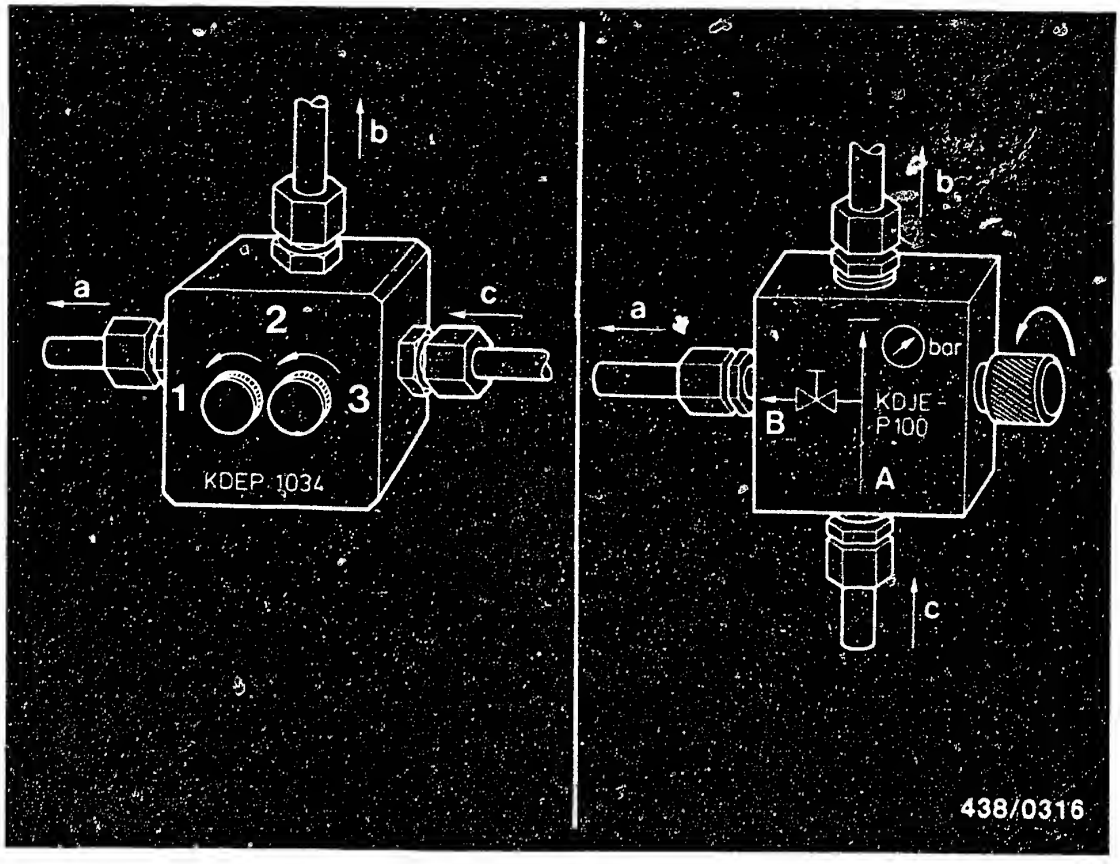
Example: Ambient temperature = 20°C
Nominal control pressure = 2.0...2.4 bar gauge pressure

If the measured "cold" control pressure differs from the nominal value, this may be due to one of the following faults:

- Fuel delivery for the control-pressure circuit too low or too high. Test fuel delivery.
  Test specification = 160...240 cm^3/min.

- Fuel return from the warm-up regulator blocked or constricted (if control pressure too high).
  Eliminate constriction.

- Warm-up regulator defective. Replace warm-up regulator.



a = to warm-up regulator
b = to pressure gauge
c = from fuel distributor

14.7 Testing the "warm" control pressure

Part no. of warm-up regulator: 0 438 140 054
0 438 140 062

The test takes place with the engine stopped, once without charge-air pressure and once with simulated charge-air pressure.

Test procedure:

Temperature of engine not important.

Open the valve screw of the directional-control valve (both screws in the case of KDEP 1034). Switch on the electric fuel pump by bridging the electrical safety circuit:

Attach the plug to the warm-up regulator.

Control pressure now rises (the warm-up regulator in the process of switching off) until the "warm" control pressure is reached without charge-air pressure.

Test specification:

"Warm" control pressure
without charge-air pressure: 3.45...3.85 bar
(3.55...3.95 kgf/cm²).

If the measured "warm" control pressure differs from the test specification, this may be due to one of the following faults:

If control pressure too high:

- Fuel delivery for the control-pressure circuit too high. Test fuel delivery.
  Test specification = 160...240 cm^3/min.

- Fuel return from the warm-up regulator blocked or constricted.
  Eliminate constriction.

- Warm-up regulator has hydraulic defect.
  Replace warm-up regulator.

If control pressure too low:

- Power supply open-circuit.
  Eliminate open circuit. Ensure that the plug is contacting properly.

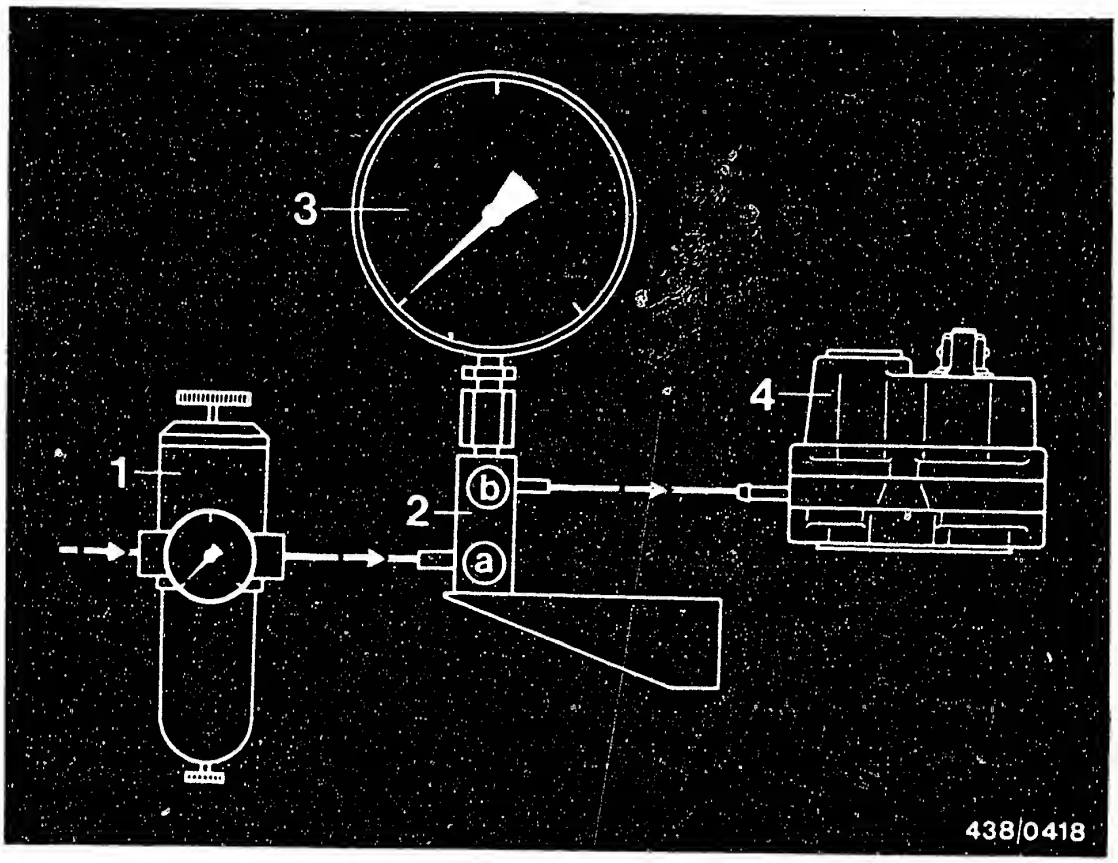
- Battery voltage too low. Voltage drop.
  Eliminate voltage drop. Minimum voltage at connector: 11.5 V.
  If necessary, repeat test with engine running in order to obtain the normal generator voltage of approx. 14 V when the vehicle is in operation.

- Fuel delivery for the control-pressure circuit too low.
  Test fuel delivery.
  Test specification = 160...240 cm^3/min.

- Warm-up regulator defective: Heating coil open-circuit.
  Hydraulic defect.
  Replace warm-up regulator.

  If the warm-up regulator has been replaced or if a defect has been eliminated, it is necessary finally to adjust the idle speed with the engine at normal operating temperature.

  Idle-speed adjustment is described on Coordinates F 8.



1 = Pressure regulator
2 = Adjusting throttle
3 = Pressure gauge
4 = Warm-up regulator

In order to test the full-load control pressure, air pressure corresponding to the charge-air pressure must be applied to the warm-up regulator.

The pressure is applied from the compressed-air mains. To do this, the following are required:

1 Pressure regulator (1) with pressure gauge 0...4 bar gauge pressure (commercially available, e.g. Krais und Fritz, Stuttgart, Type No. 104).
1 Adjusting throttle (2) Bosch 0 688 130 132.

In addition, pressure gauge (3) 0...1.6 bar gauge pressure, quality class 1.0 (commercially available, e.g. Wika No. 4184).

Note:
The tools and equipment listed are frequently already available in the diesel workshop and are used there for testing the manifold-pressure compensators on diesel fuel-injection pumps.

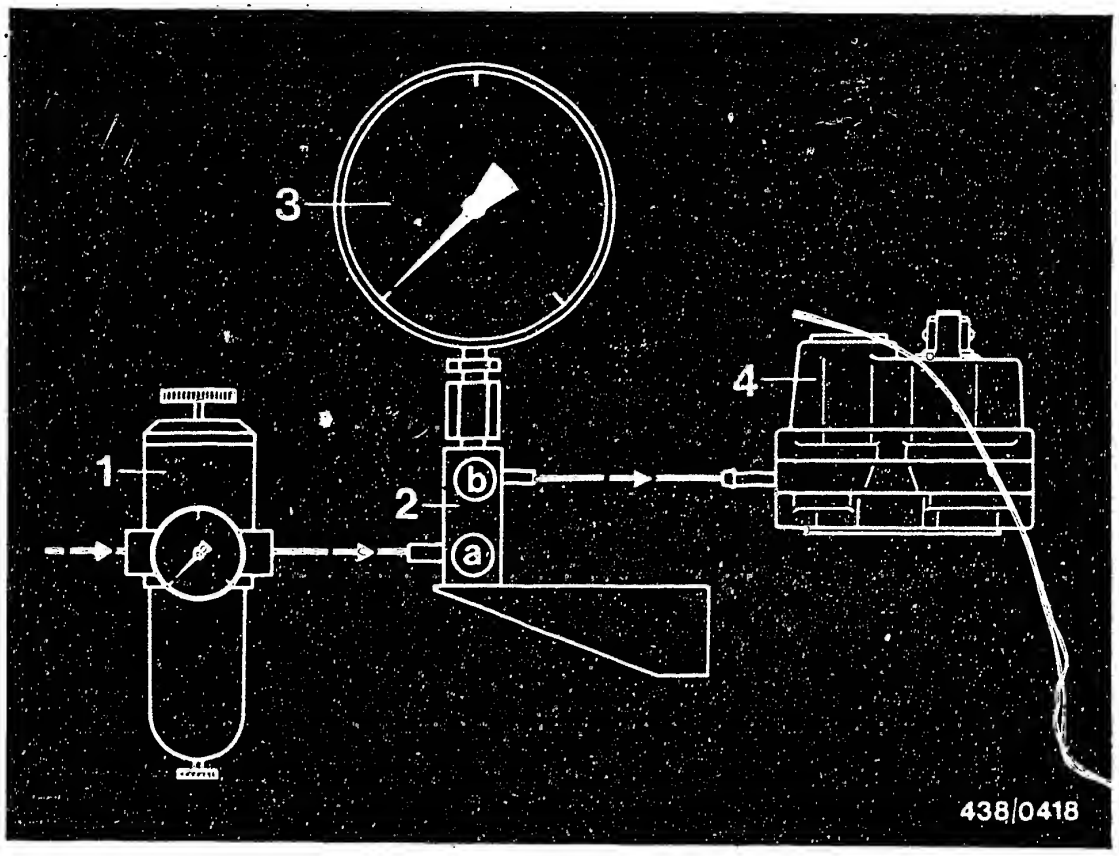
Test procedure for full-load control pressure:

The electric fuel pump remains switched on; the electric connector on the warm-up regulator remains connected.

Test specification:

Test with simulated charge-air pressure (gauge pressure):

Charge-air pressure:	Control pressure:
470...600 mbar (350...450 mmHg)	2.7...3.1 bar (2.8...3.2 kgf/cm²)

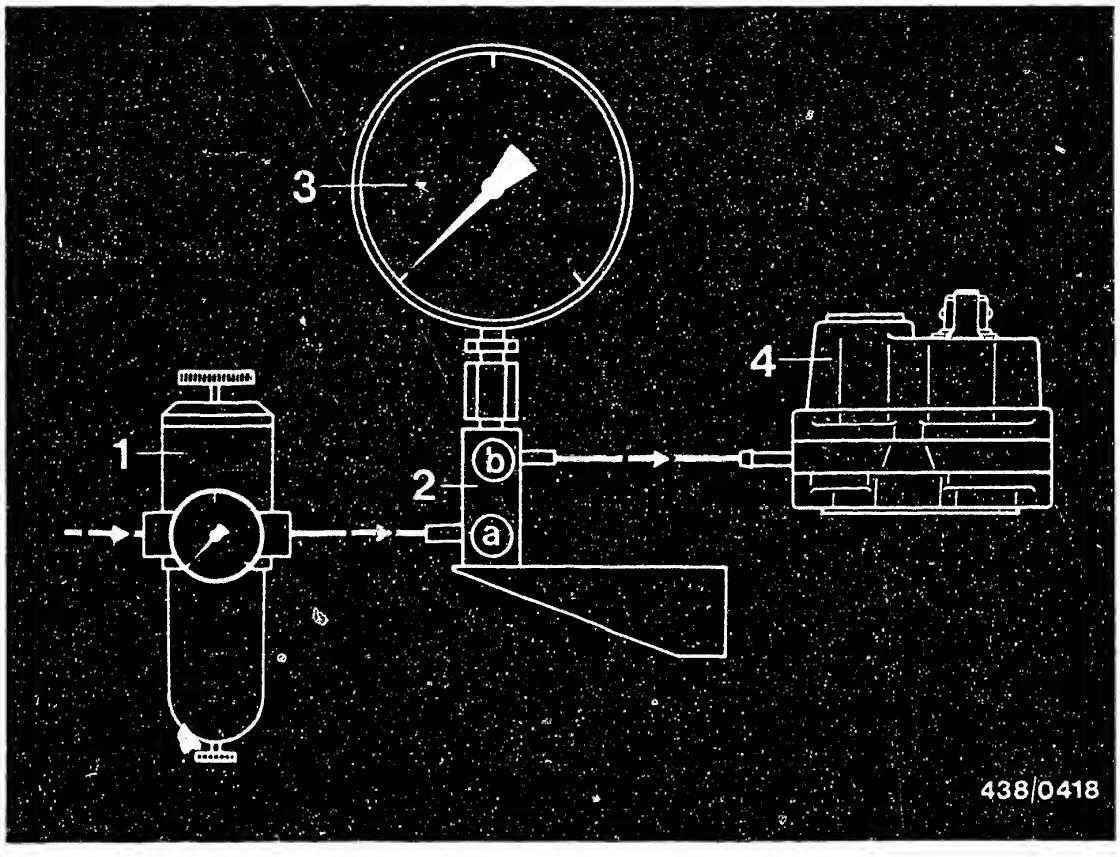


Set the pressure to max. 0.5 bar gauge pressure at the pressure regulator (1).

Establish a connection from the upper connection of the adjusting throttle (2) to the warm-up regulator (3).

Open screw plug b of the adjusting throttle. Using adjusting screw a, set the charge-air pressure in accordance with the test specification. The control pressure must drop to the value "with charge-air pressure".

If this is not the case, replace the warm-up regulator.

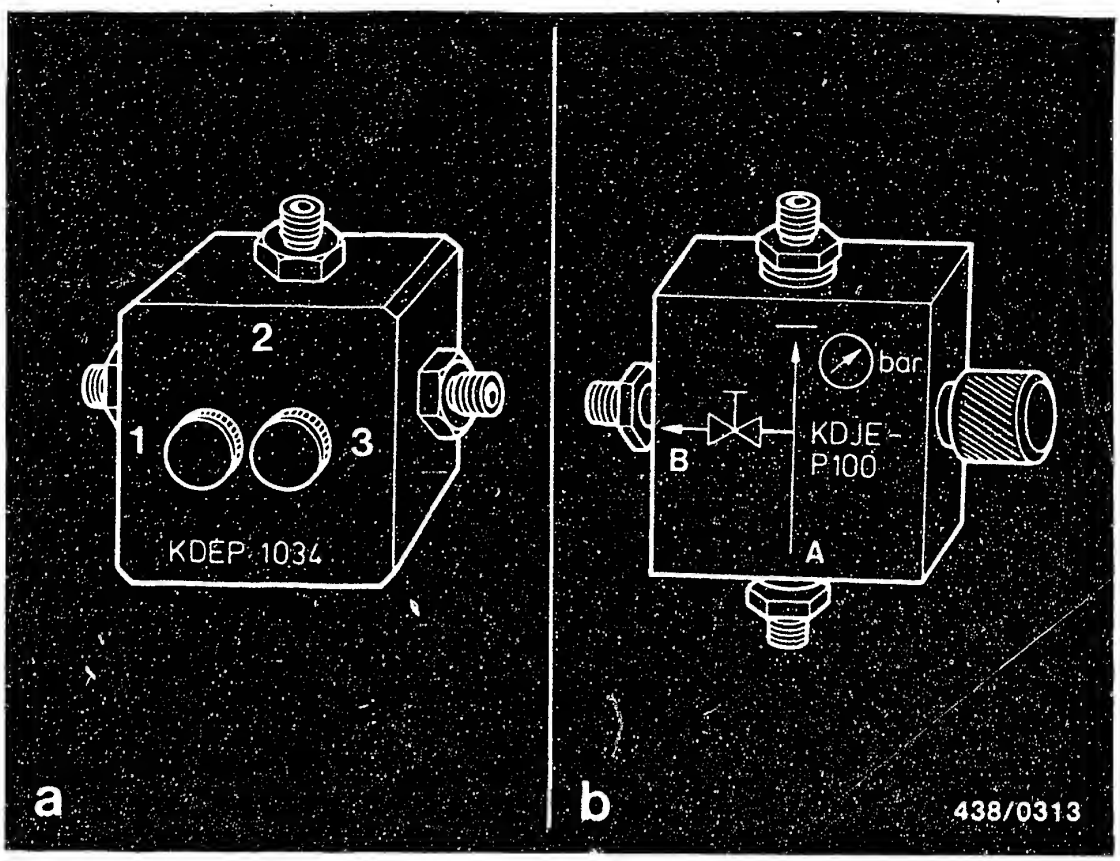


14.8 Leak test on full-load diaphragm in warm-up regulator:

Test specification:

Test pressure:	600 mbar (450 mm Hg)
Pressure drop:	max. 66 mbar (50 mm Hg) /15 s

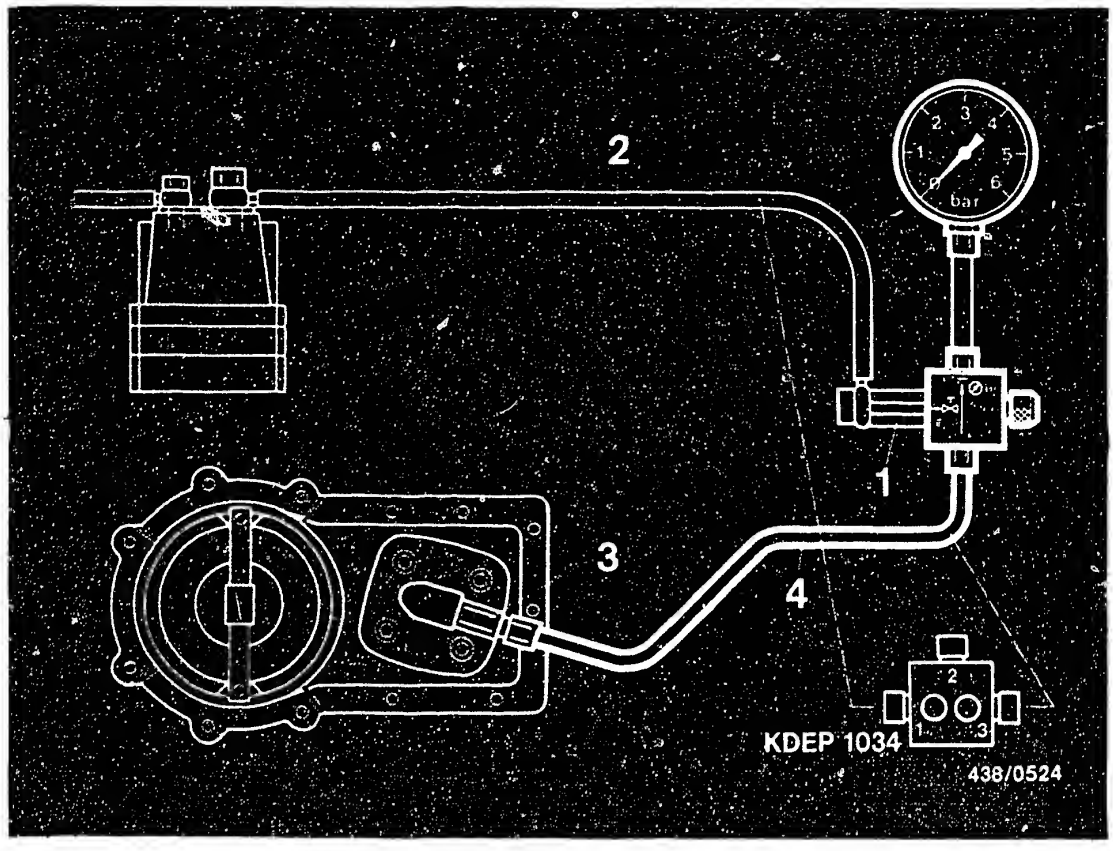
Switch off the electric fuel pump.
Set the test pressure at adjusting screw a in accordance with the test specification.
Close screw plug b and test the pressure drop. If leaking outside tolerance, replace the warm-up regulator.
Caution: The testing of the full-load control pressure and the leak test on the full-load diaphragm should be included in any trouble-shooting procedure. If there is no full-load enrichment or it is insufficient, this can lead to engine damage.



15. Testing and adjusting the primary (system) pressure:

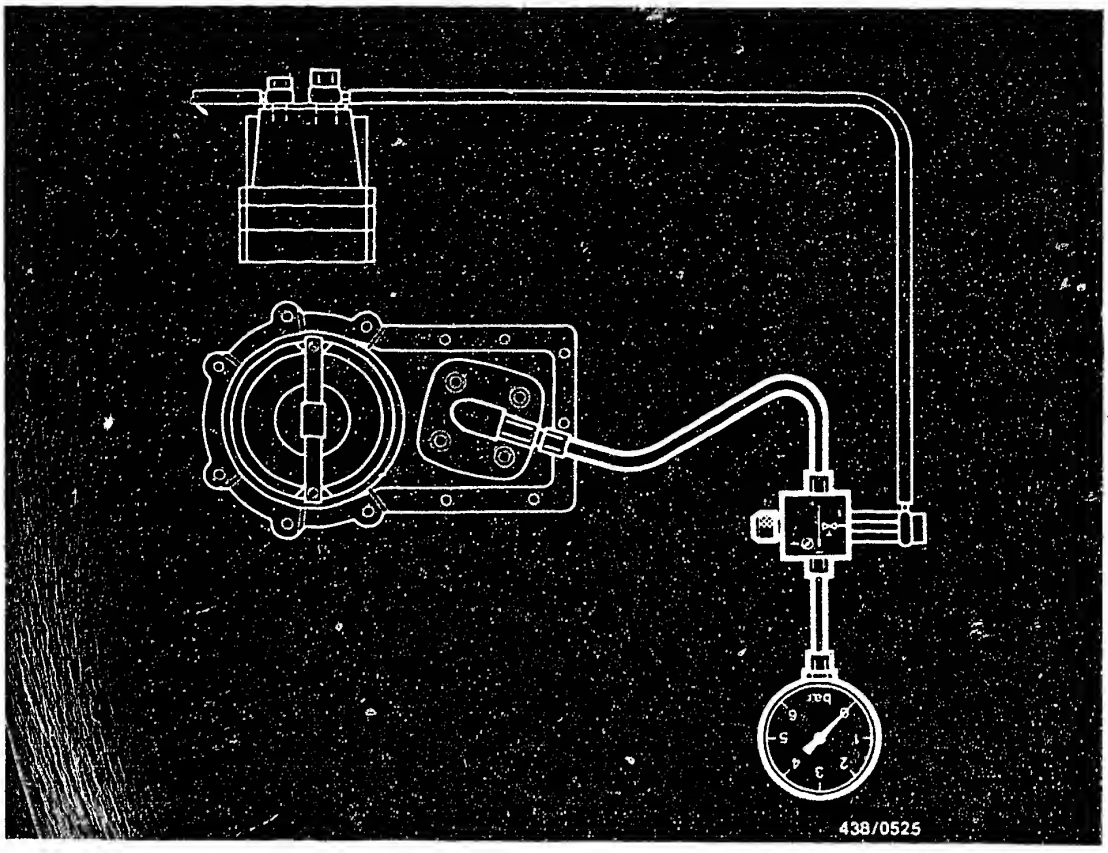
15.1 Mounting the pressure tester KDJE-P 100 (formerly KDEP 1034):

The pressure tester KDEP 1034 is equipped with a three-way valve with 2 separate valve screws. The connections of the directional-control valve are numbered (Fig. a). Since the end of 1979 the pressure tester KDJE-P 100 has been supplied, its directional-control valve has only one valve screw (Fig. b). The connections of this directional-control valve are identified by symbols:
A = Inlet (from the fuel distributor)
B = Outlet (to the warm-up regulator)



Caution:
When the directional-control valve is not in use, always keep the valve screw(s) open in order to relieve the pressure on the seal rings.

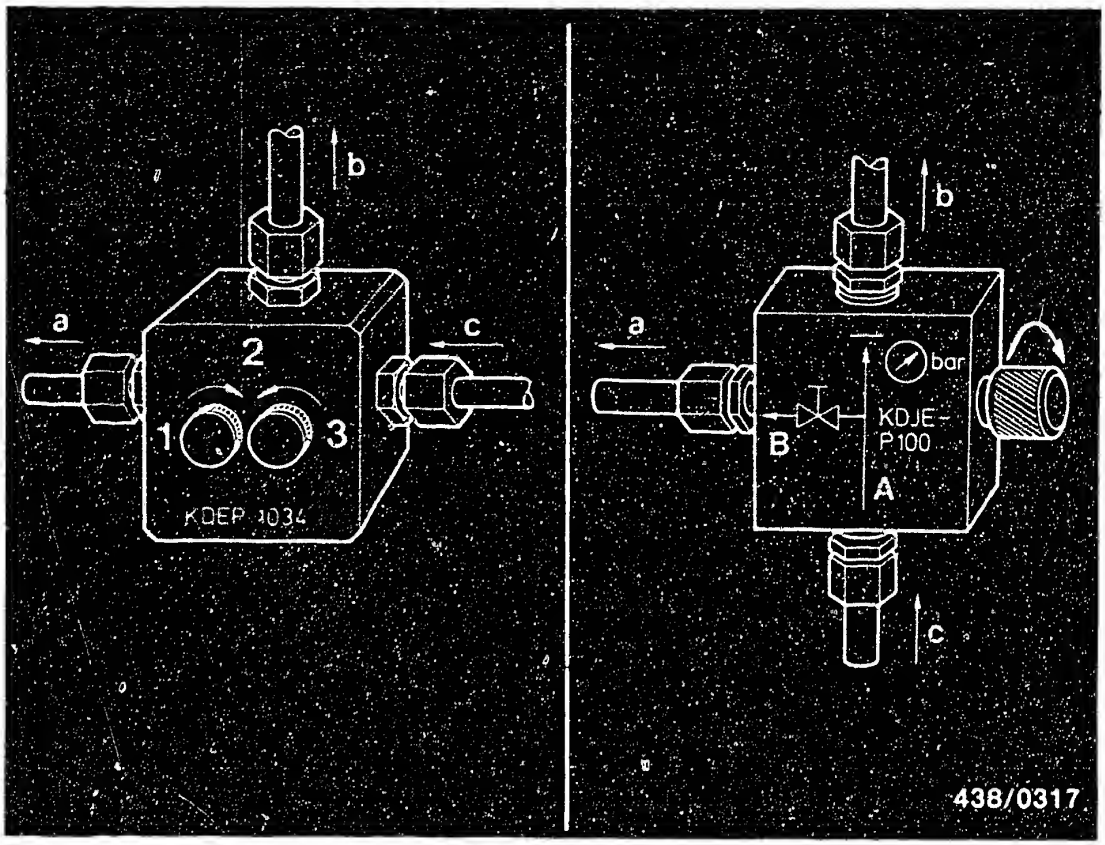
The directional-control valve of the pressure tester is connected into the control-pressure line from the fuel distributor to the warm-up regulator. Fit using connecting-parts set KDJE-P 100/10.
Screw the adapter of the connecting-parts set with a seal ring onto connection B or 1 of the directional-control valve (1). Unscrew the control-pressure line (to the warm-up regulator) from the fuel distributor and connect to the adapter (2). Screw the connecting piece of the connecting-parts set into the control-pressure connection port on the fuel distributor (3) and connect to connection A or 3 of the directional-control valve using hose (4).



15.2 Bleeding the pressure tester:

Disconnect the electric plug from the warm-up regulator. Let the pressure gauge hang down (hose fully extended). Switch on the electrical fuel pump by bridging the electrical safety circuit:

Open and close the valve screw of the directional-control valve (valve screw 1 in the case of KDEP 1034) in a 10-second rhythm about 5 times. Then hang the pressure gauge from a suitable support (e.g. from one of the struts under the engine hood).
Open valve screw of directional-control valve (both screws in the case of KDEP 1034) (turning to the left).



a = To warm-up regulator
b = To pressure gauge
c = From fuel distributor

15.3 Testing the primary pressure:

The test is performed with the engine switched off. The temperature of the engine is not important.

Close the valve screw of directional-control valve KDJE-P 100.
In the case of KDEP 1034, close valve screw 1, open valve screw 3.

Switch on the electric fuel pump by bridging the electrical safety circuit:
The pressure gauge now indicates the primary pressure.

Test specification for primary pressure:
6.0...6.7 bar (6.1...6.8 kgf/cm²) gauge pressure

Possible causes for too low a primary pressure:

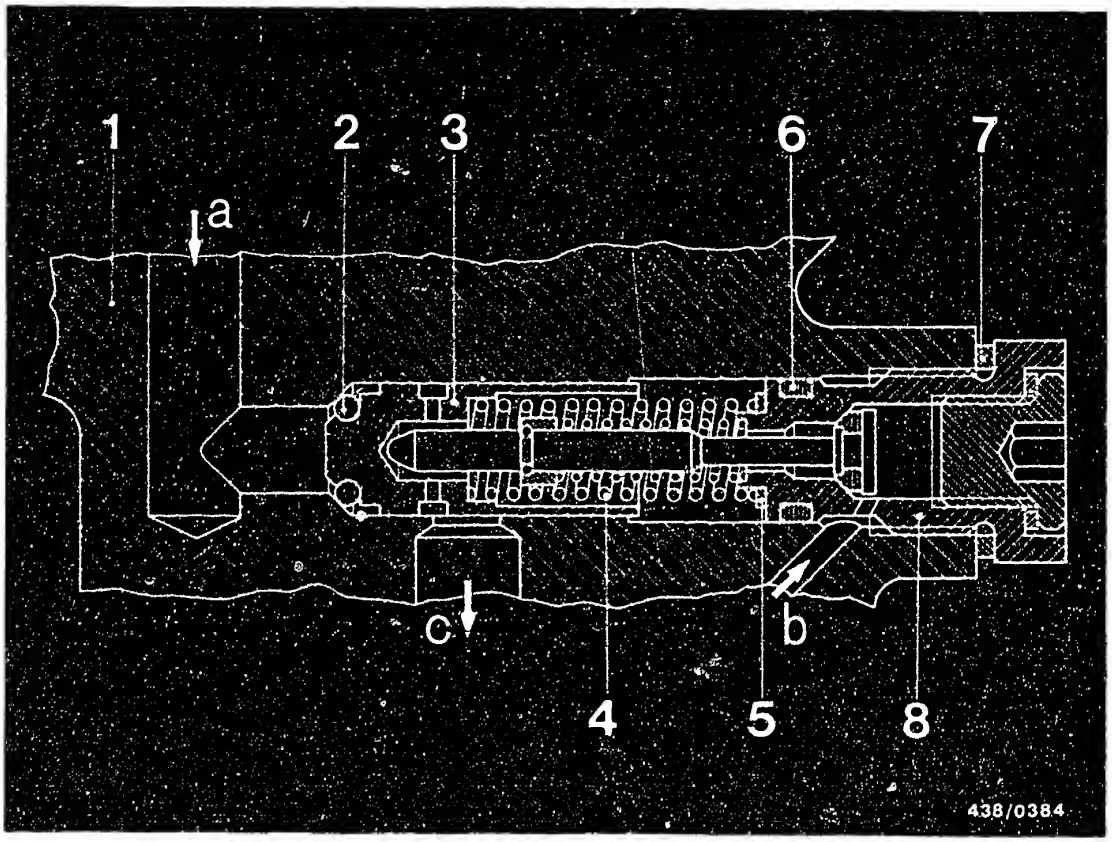
- Fuel supply faulty.
  (Delivery of electric fuel pump too low).

- Primary pressure set incorrectly.
  A precondition for readjustment of the primary pressure is always that the fuel supply is in order.
  Measure the fuel delivery.
  Test specifications: min. 1050 cm³/30 s

Possible causes for too high a primary pressure:

- A restriction in the return line leading to the fuel tank.

- Primary-pressure regulator set incorrectly.
  For this reason, before readjusting too high a primary pressure, always first check the condition of the return line leading to the fuel tank.



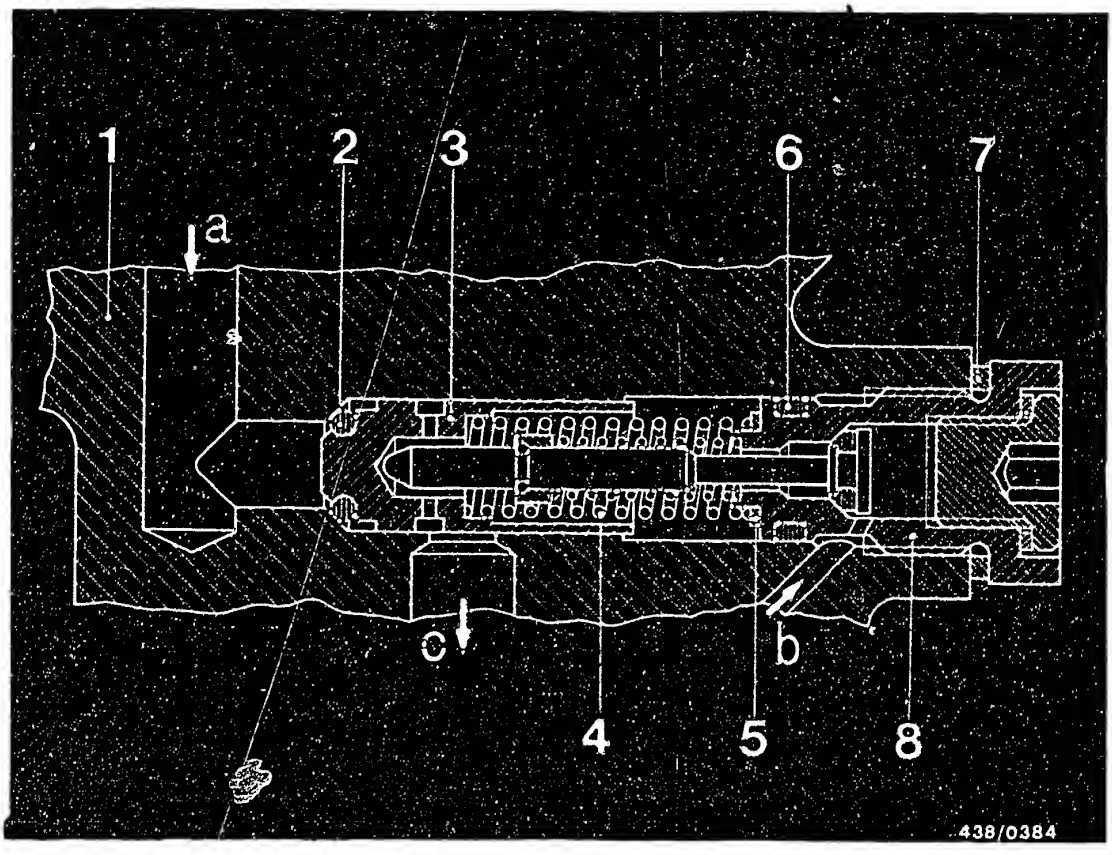
a = Primary pressure
b = From warm-up regulator
c = Fuel return

1 = Fuel-distributor housing	5 = Shim(s)
2 = O-ring	6 = O-ring
3 = Control piston	7 = Flat seal ring
4 = Control spring	8 = Screw plug

15.4 Adjusting the primary pressure:

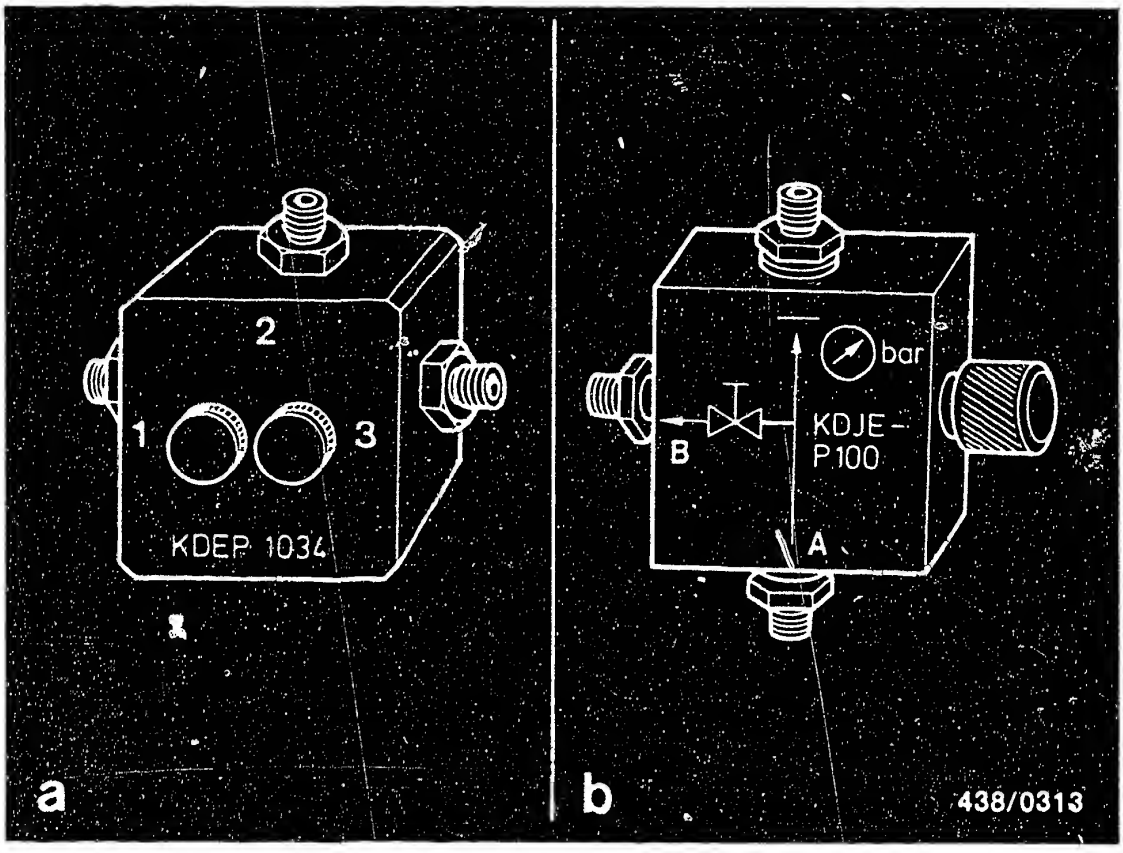
Adjustment value - primary pressure:
6.2...6.5 bar (6.3...6.6 kgf/cm²)

The primary pressure is readjusted by replacing the shims (Item 5).
Note: 0.1 mm more of shim thickness means about 0.15 bar pressure increase and vice versa.



To do this, screw out the large screw plug (Item 8) together with the push valve. After carrying out the adjustment, always fit the screw plug with a new flat seal ring (Item 7) and O-ring (Item 6).

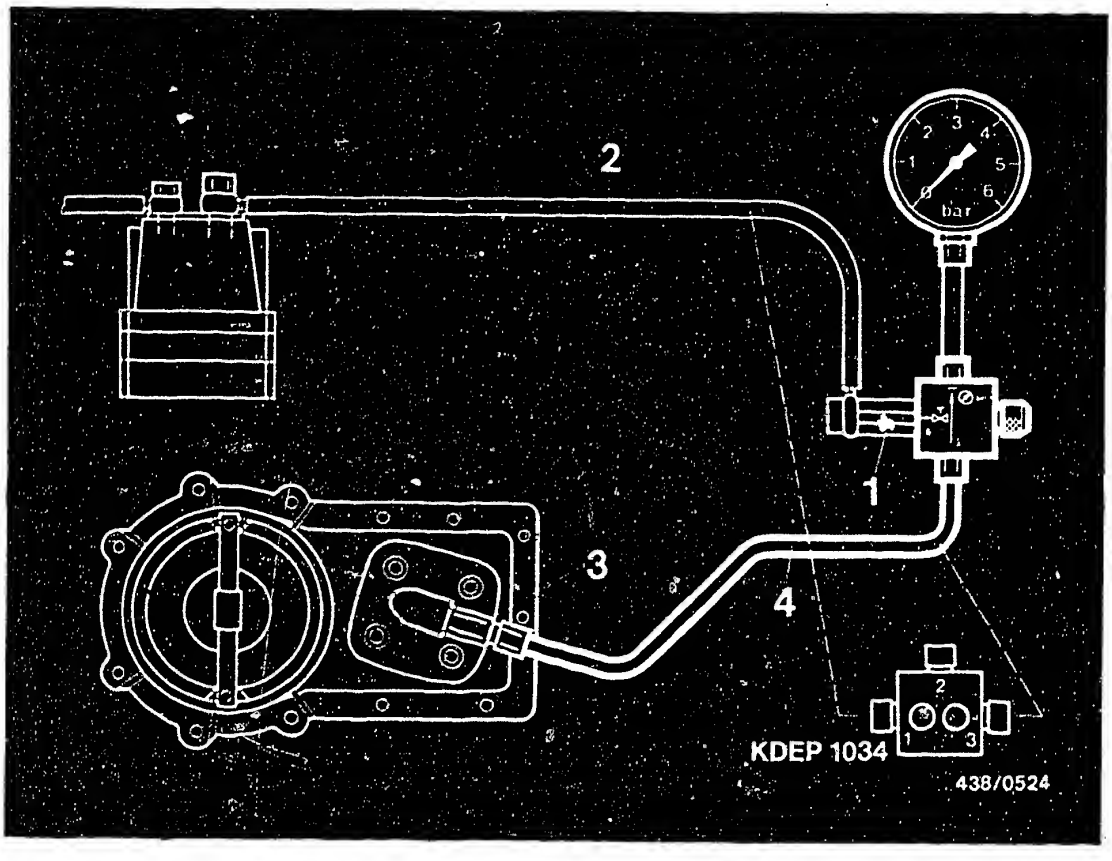
The control piston (Item 3) of the primary-pressure regulator must not be lost. It was matched specially to the fuel distributor housing in the manufacturing plant and therefore is the only part of the primary-pressure regulator which must not be replaced.



16. Testing the entire fuel system for leaks:

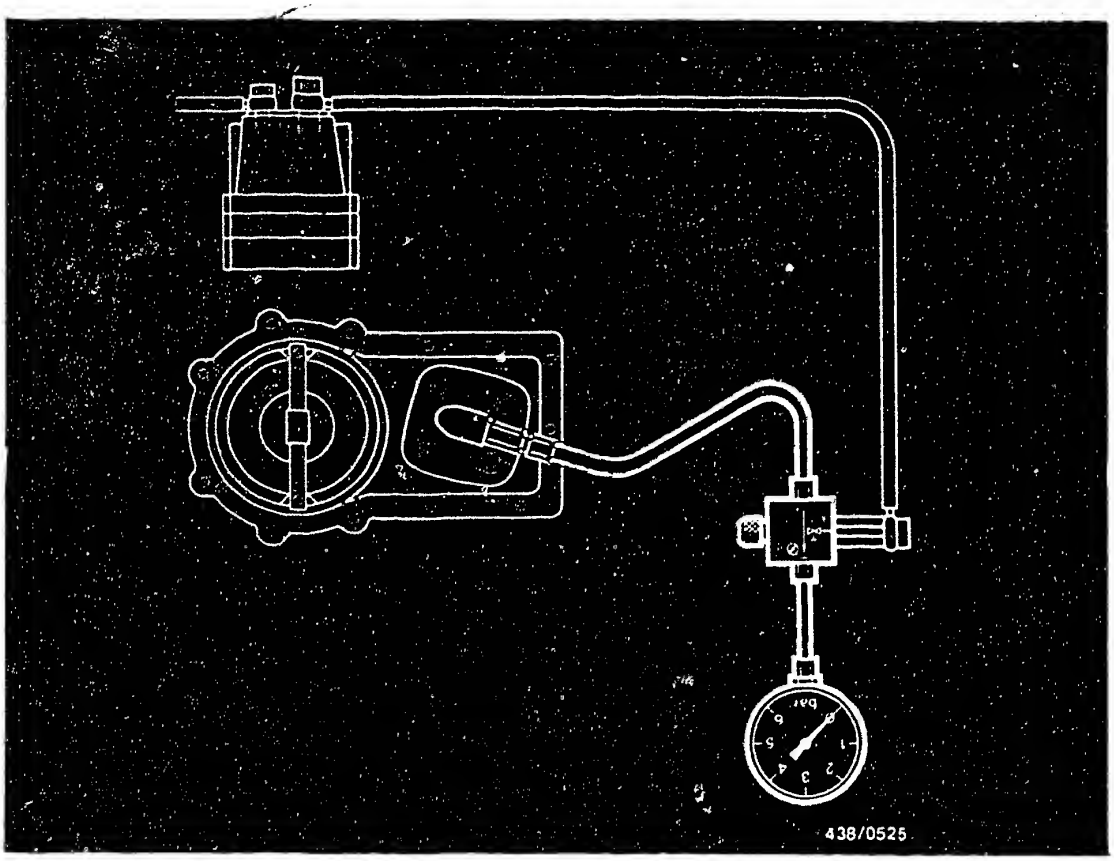
16.1 Mounting the pressure tester KDJE-P 100 (formerly KDEP 1034):

The pressure tester KDEP 1034 is equipped with a three-way valve with 2 separate valve screws. The connections of the directional-control valve are numbered (Fig. a). Since the end of 1979 the pressure tester KDJE-P 100 has been supplied. Its directional-control valve has only one valve screw (Fig. b). The connections of this directional-control valve are identified by symbols:
A = Inlet (from the fuel distributor)
B = Outlet (to the warm-up regulator)



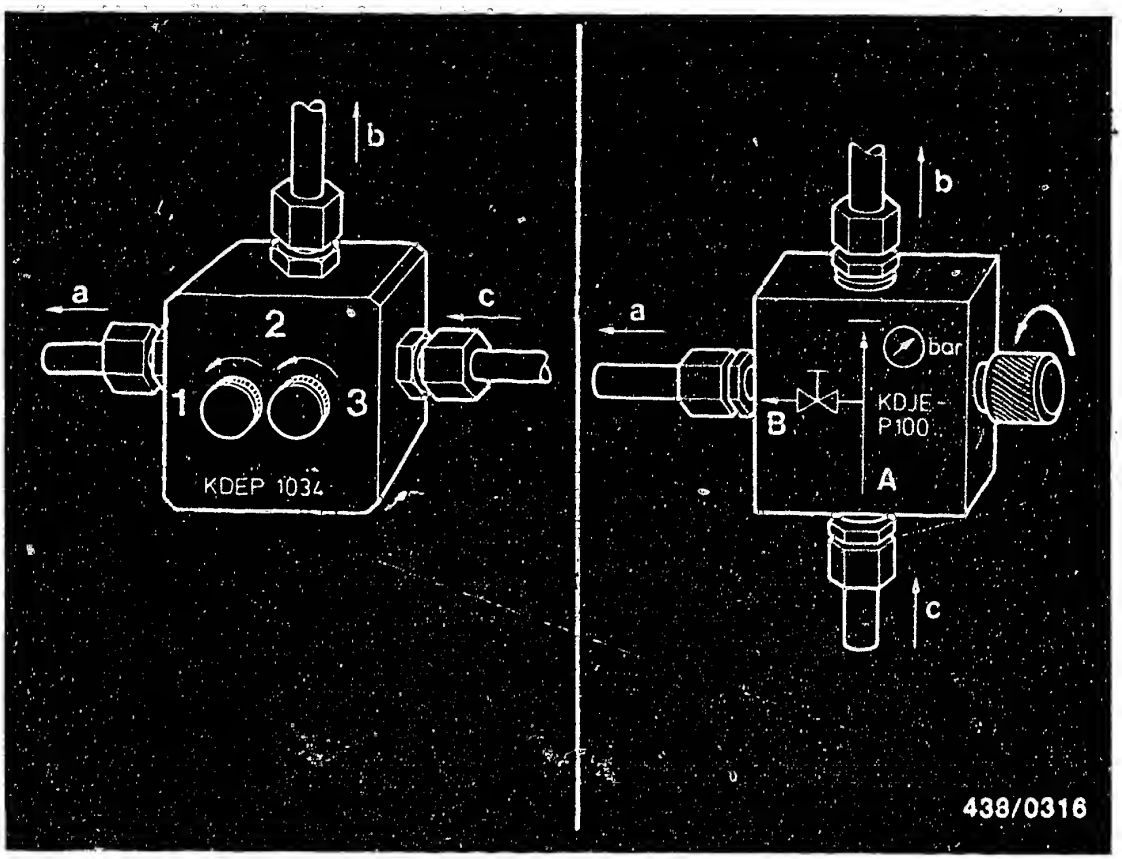
Caution:
When the directional-control valve is not in use, always keep the valve screw(s) open in order to relieve the pressure on the seal rings.

The directional-control valve of the pressure tester is connected into the control-pressure line from the fuel distributor to the warm-up regulator. Fit using connecting-parts set KDJE-P 100/10.
Screw the adapter of the connecting-parts set with a seal ring onto connection B or 1 of the directional-control valve (1). Unscrew the control-pressure line (to the warm-up regulator) from the fuel distributor and connect to the adapter (2). Screw the connecting piece of the connecting-parts set into the control-pressure connection port on the fuel distributor (3) and connect to connection A or 3 of the directional-control valve using hose (4).



16.2 Bleeding the pressure tester:

Disconnect the electric plug from the warm-up regulator and the auxiliary-air device.
Let the pressure gauge hang down (hose fully extended).
Switch on the electric fuel pump by bridging the electrical safety circuit:
Open and close the valve screw of the directional-control valve (valve screw 1 in the case of KDEP 1034) in a 10-second rhythm about 5 times. Then hang the pressure gauge from a suitable support (e.g. from one of the struts under the engine hood).
Open valve screw of directional-control valve (both screws in the case of KDEP 1034) (turning to the left).



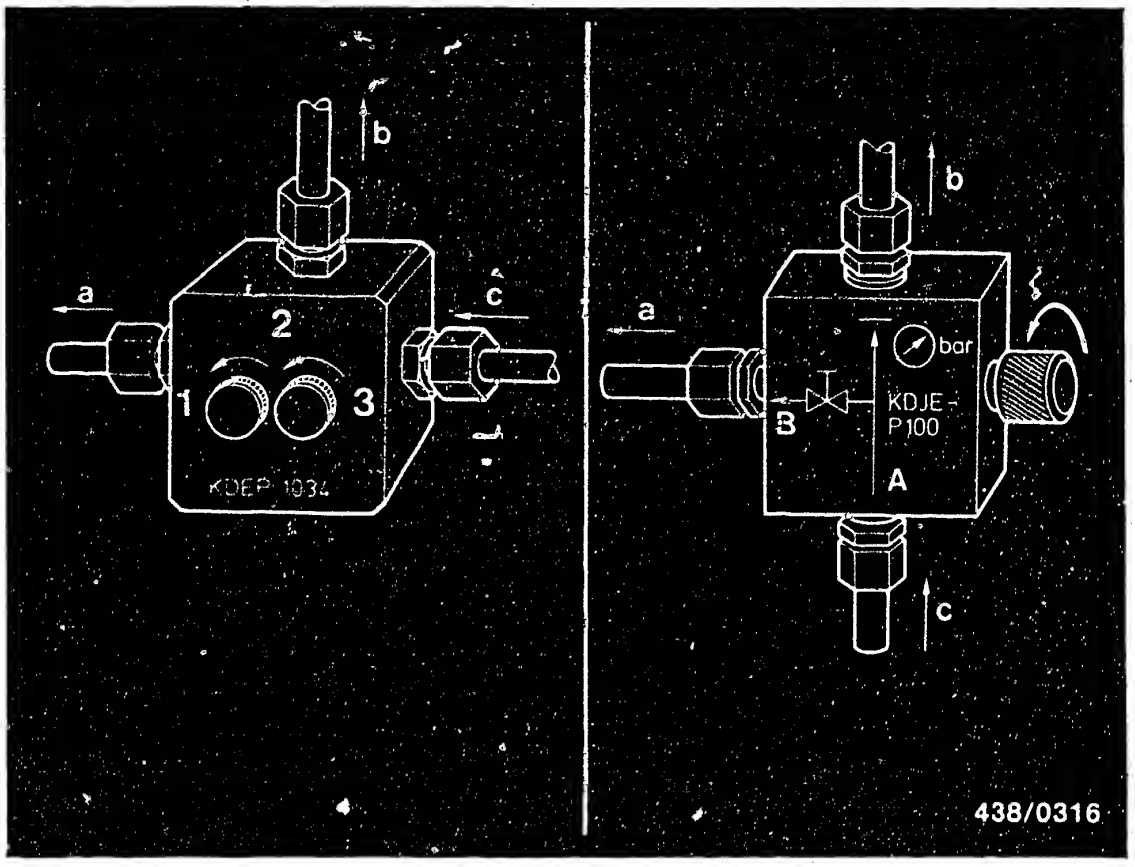
a = To warm-up regulator
b = To pressure gauge
c = From fuel distributor

16.3 Leak test:

The test is performed with the engine switched off.

Make the test with a warm engine but not immediately after the engine has been operated at a high temperature.

Open the valve screw of the directional-control valve (both valves in the case of KDEP 1034).



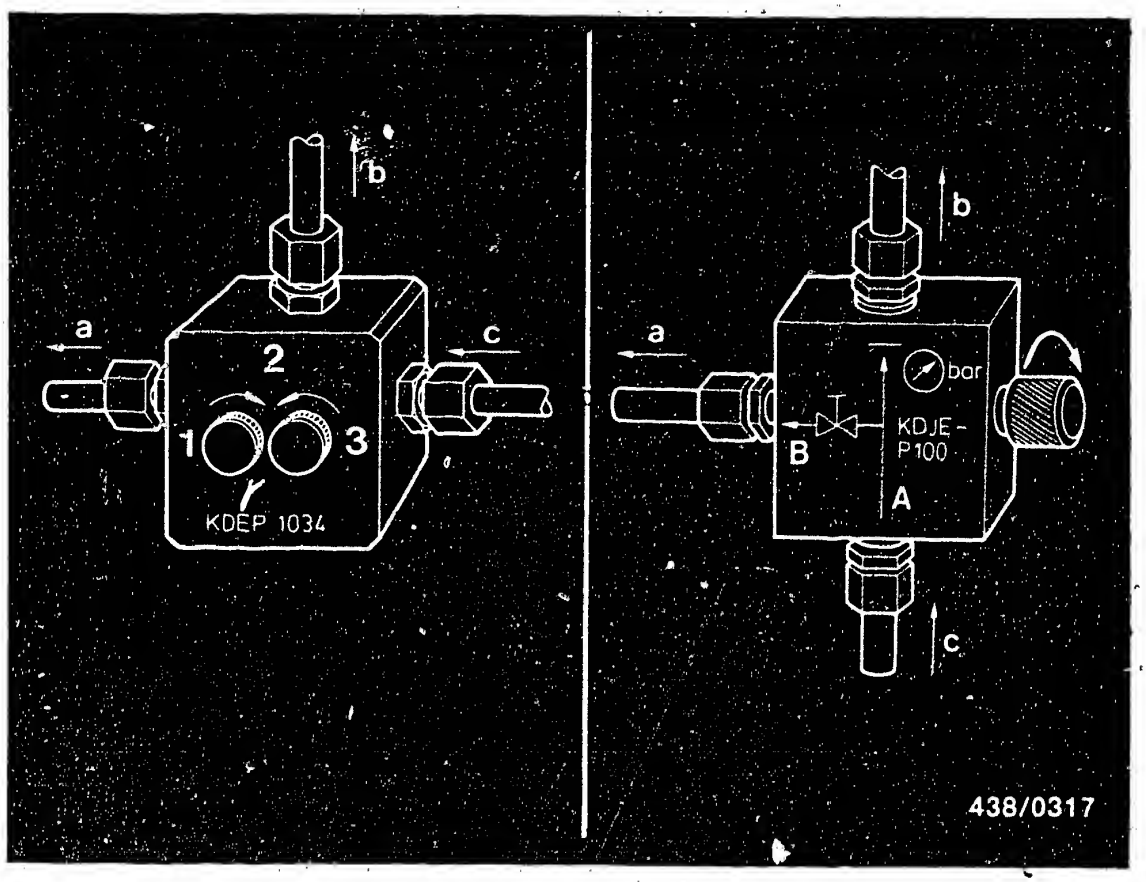
Switch on the electric fuel pump by bridging the electrical safety circuit until the warm-up regulator has ceased to operate ("warm" control pressure).

Switch the electric fuel pump off again and observe the drop in pressure on the pressure gauge.

Test specifications for leak test:

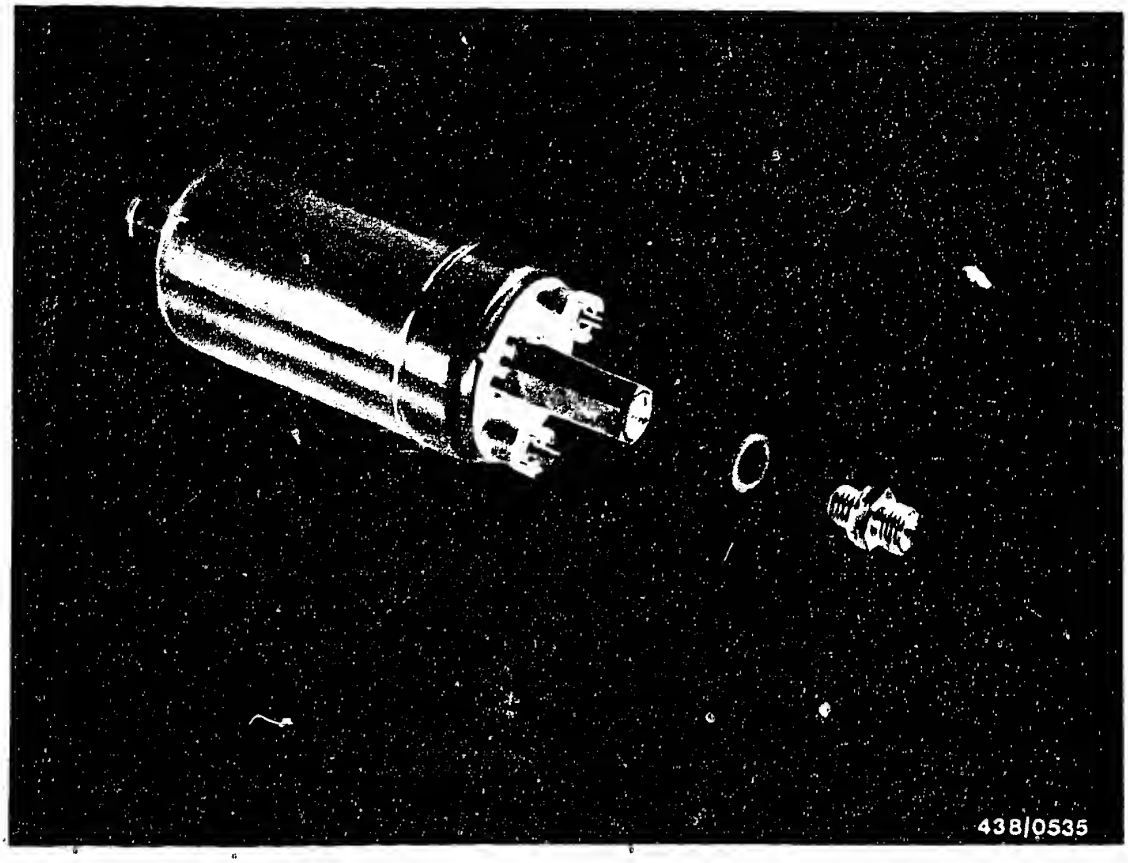
Minimum pressure after

10 minutes 2.0 bar (2.1 kgf/cm²) gauge pressure
20 minutes 1.7 bar (1.8 kgf/cm²) gauge pressure



a = To warm-up regulator
b = To pressure gauge
c = From fuel distributor

If the pressure drops too quickly, repeat the test with the control-pressure circuit disconnected.
Position of the valve screws:
Close the valve screw of the directional-control valve KDJE-P 100.
In the case of KDEP 1034, close valve screw 1, open valve screw 2.
If the same result is found, the leak is in the primary-pressure circuit.
If the test results are correct during the second test, the leak is in the control-pressure circuit.



16.4 Possible causes of a defect in the primary-pressure circuit:

- Non-return valve in the pressure connection piece of the electric fuel pump has a leak.

The non-return valve is built permanently into the pressure connection piece and cannot be replaced.

In order to avoid changing the complete electric fuel pump when a non-return valve has a leak, a parts set with a separate non-return valve has been produced which can be used in the Porsche 924 fuel pump.

Part No. of the parts set: 1 587 010 004.
Contents: 1 connecting piece with built-in non-return valve
1 seal ring

Installation:
Thoroughly clean the connection of the delivery line on the electric fuel pump.

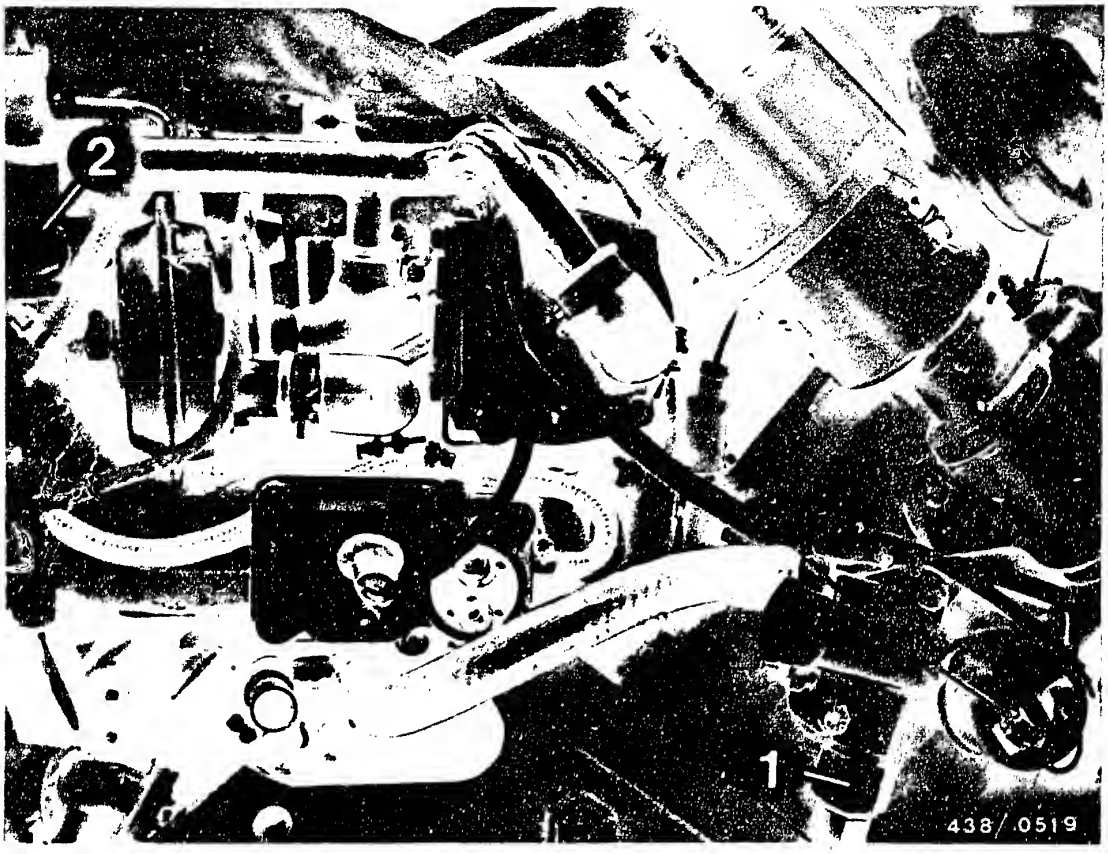
Pinch off the intake hose (between pre-supply pump and electric fuel pump) (e.g. using hose clamper W 157 from Matra Co.).

Unscrew the delivery line, collecting any escaping fuel and unscrew the double threaded fitting from the delivery fitting.
The defective original non-return valve remains in the electric fuel pump.

Screw the new non-return valve from the parts set with a seal ring into the delivery fitting and tighten to a torque of 17...25 Nm.

Connect the delivery line and remove the hose clamper from the intake hose.

Check the connections for leaks with the electric fuel pump operating.



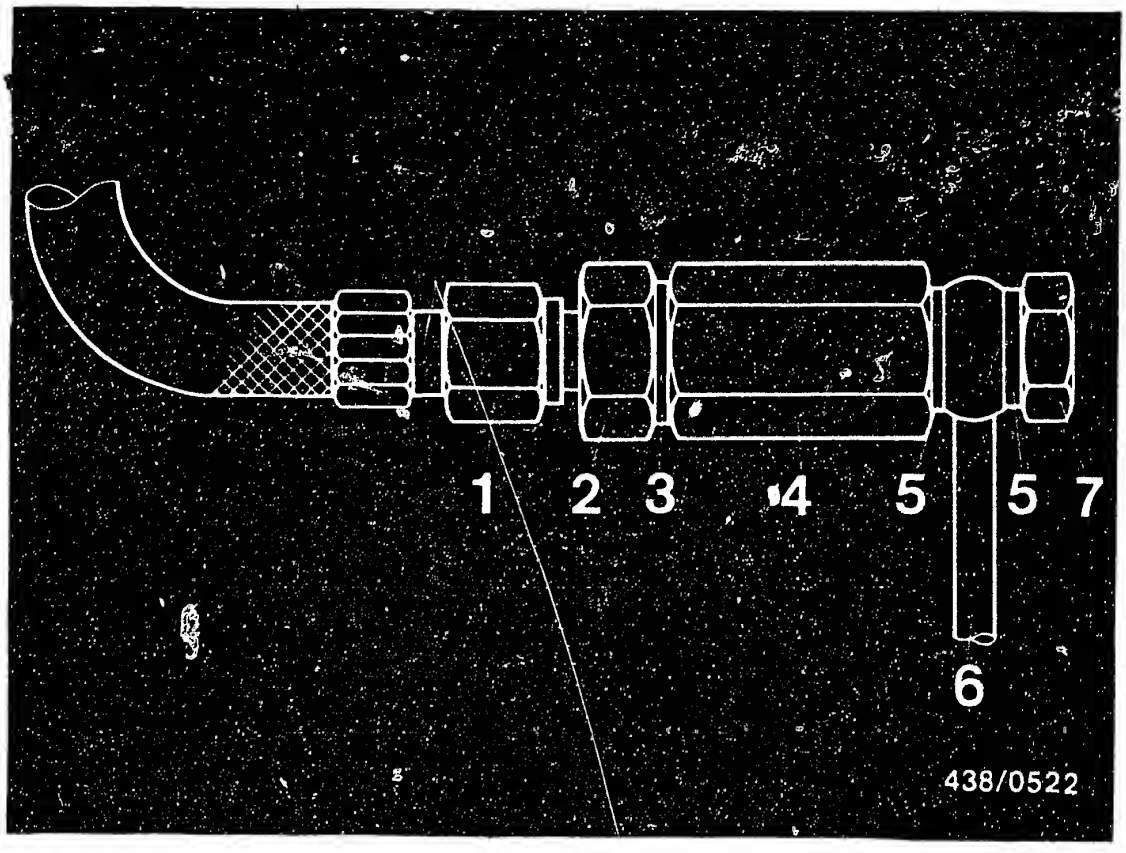
- Start valve leaking:

For improved access to the start valve (2) it is a good idea to remove the ignition coil first.

Remove the electric connector from the valve.

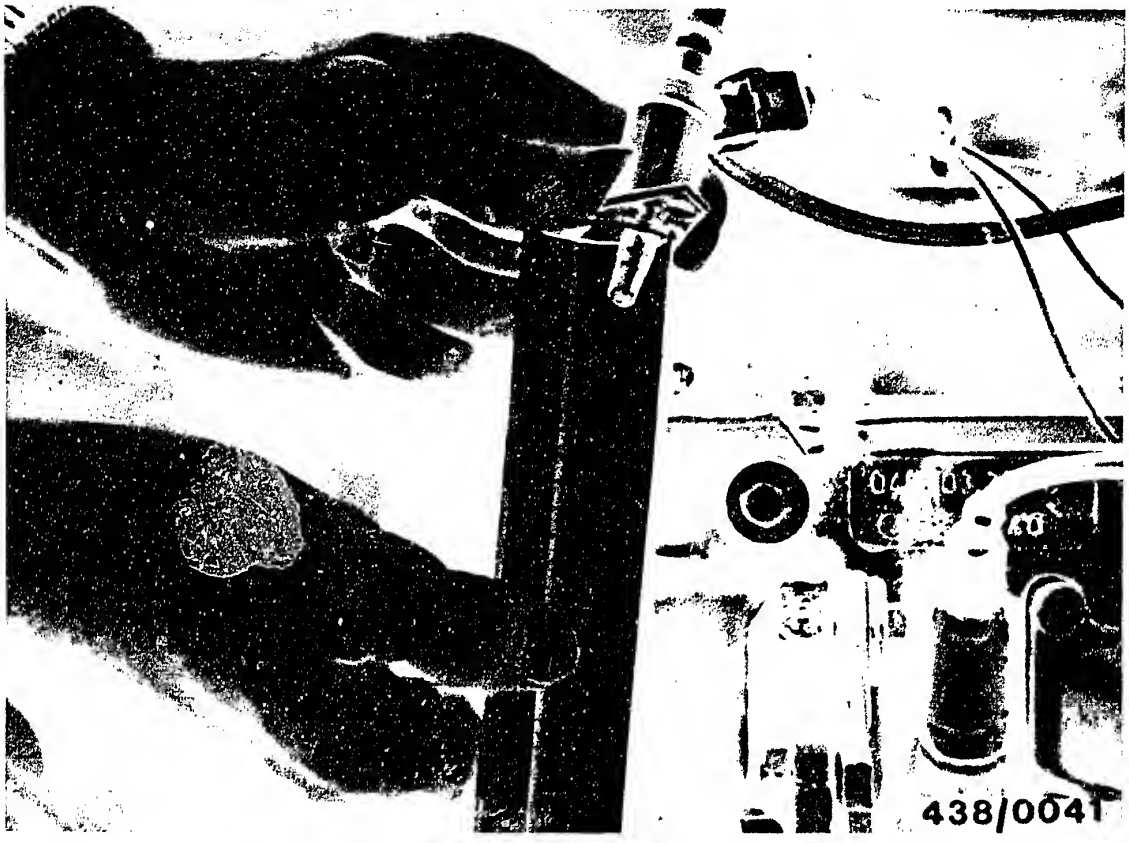
Unscrew the fuel supply line from the valve (steel line) and remove the valve.

Re-connect the fuel supply line to the valve using a flexible hose line as follows:

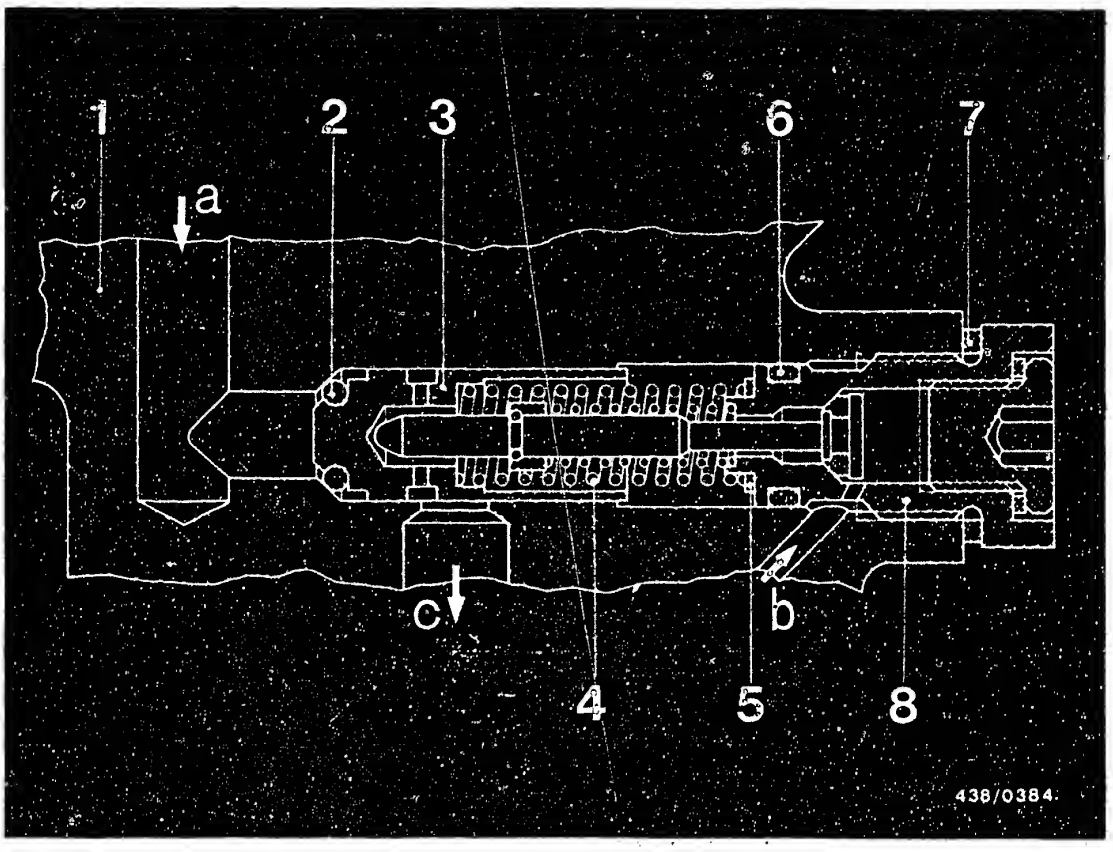


1 = Hose line of pressure tester KDJE-P 100
2 = Double threaded fitting 2 x M12x1.5, 1x60° internal taper
3 = Seal ring
4 = Adapter from connecting-parts set KDJE-P100/10
5 = Seal rings
6 = Fuel line
7 = Original inlet-union screw

Connect the hose line with the original inlet-union screw to the adapter from connecting-parts set KDJE-P100/10 (previously KDEP 1034/10). Screw a commercially available double fitting 2xM12x1.5 into the adapter. Connect a hose line of the pressure tester KDJE-P100 (previously KDEP 1034) to the double fitting.

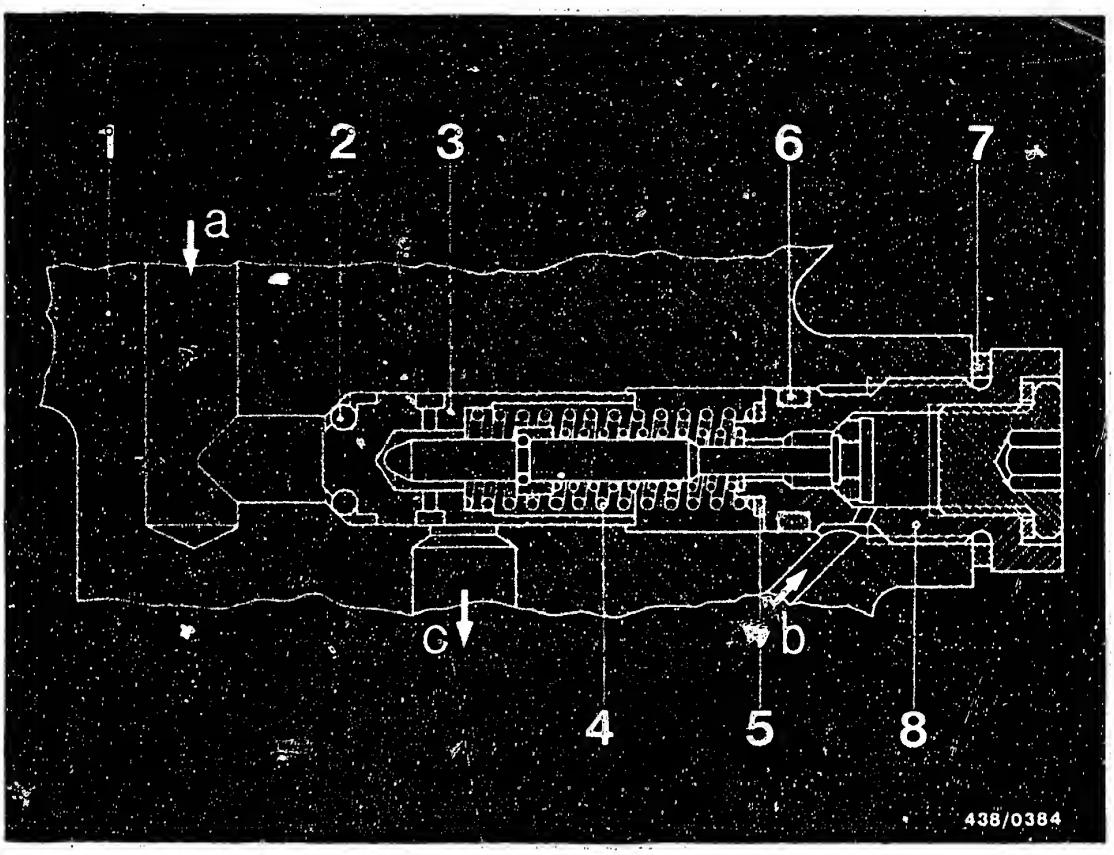


Using the connecting piece M 12x1.5/M8x1 from the connecting-parts set, connect the start valve to the hose line.
Hold the start valve in a suitable container (e.g. graduate).
Switch on the electric fuel pump by bridging the safety circuit and dry off the nozzle of the start valve.
Within the next minute no fuel must drip from the nozzle of the start valve. Even if shaken and knocked the start valve must not leak.
Then switch off the electric fuel pump again. Replace the start valve if it does not open or if it has a leak.
When a leaking start valve or a defective thermo-time switch has been replaced, carry out the idle adjustment with the engine at normal operating temperature. Idle adjustment is described on Coordinates F 8.



- Seal ring on control piston of primary pressure regulator has a leak.

Replace seal ring:
Clean the fuel distributor in the region of the primary-pressure regulator. Screw out the large screw plug (8) with the complete push valve. Also remove shims (5), control spring (4) and control piston (3). Replace O-ring (2), fit control piston and control spring.
Screw in screw plug with complete push valve and with shims (as they were before removal) and new seal rings (6 and 7).
Finally check primary pressure and, if necessary, adjust by changing the shims (5).



16.5 Possible cause of trouble in the control-pressure circuit:

Push-up valve in the primary-pressure regulator leaking. The seal ring in the push-up valve is rigidly vulcanized onto the valve needle. If there is a leak, therefore, replace the complete push-up valve (ready-assembled unit).
Clean the fuel distributor in the region of the primary-pressure regulator. Unscrew the large screw plug (8) with the complete push-up valve. Pay attention to the control spring (4) and shims (5).
Screw in the new push-up valve with the original number of shims (5), a new O-ring (6) and flat seal ring (7). Then check the primary pressure again and, if necessary, adjust by changing the shims (5).

17. Testing the injection valves

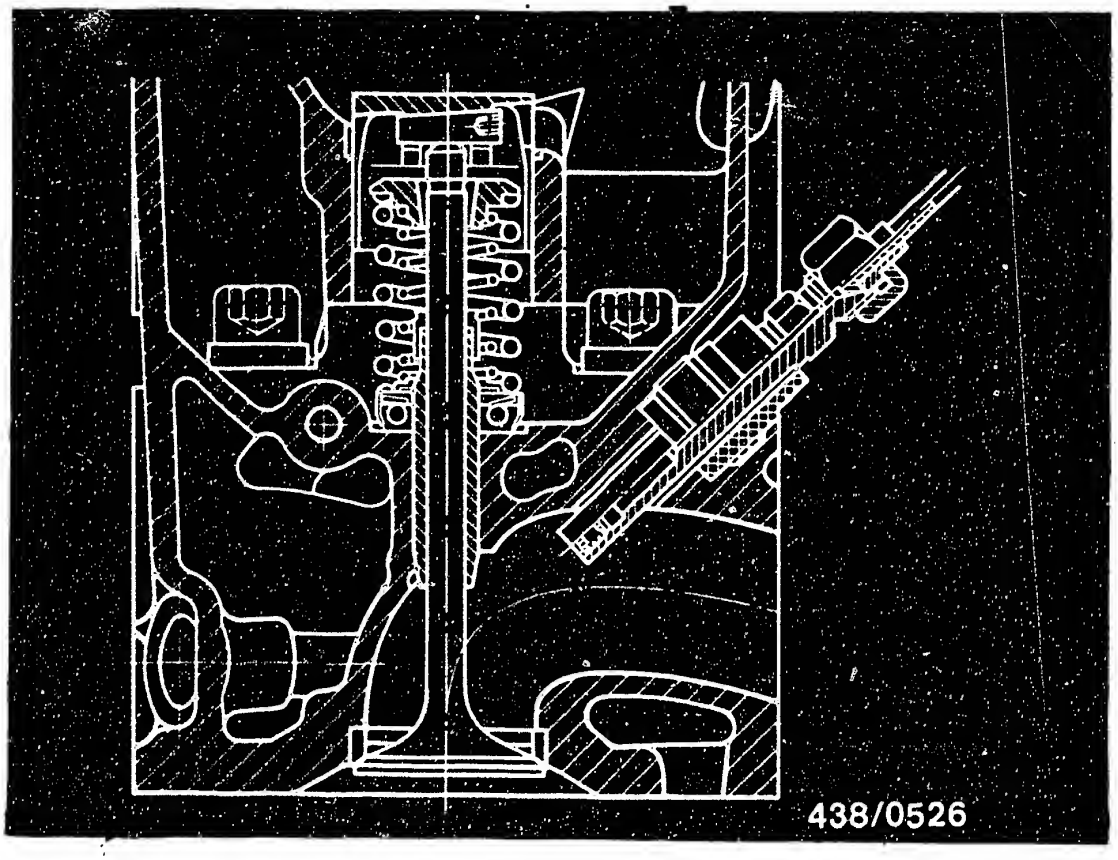
17.1 Test equipment and test media

The following testing specification refers to valve testers KDJE-P 400 (previously KDEP 7452) and 0 681 200 700.

Observe the test-media specification!

Test media: Calibrating fluid (Shell K 30, Esso-Varsol, Shell Mineral Spirits 135)
or
Bosch, Part No. VS 14 942-CH
(former Part No. 5 973 340 650)
The calibrating fluid can be obtained in 5 l metal cans from the following supplier:
Firma
Oskar Gnamm GmbH & Co
D-7531 Kämpfelbach-Bilfingen

Caution:
For safety reasons, never use normal gasoline or similar easily inflammable and combustible liquids.
Even with calibrating fluid, be sure to observe the local official regulations.

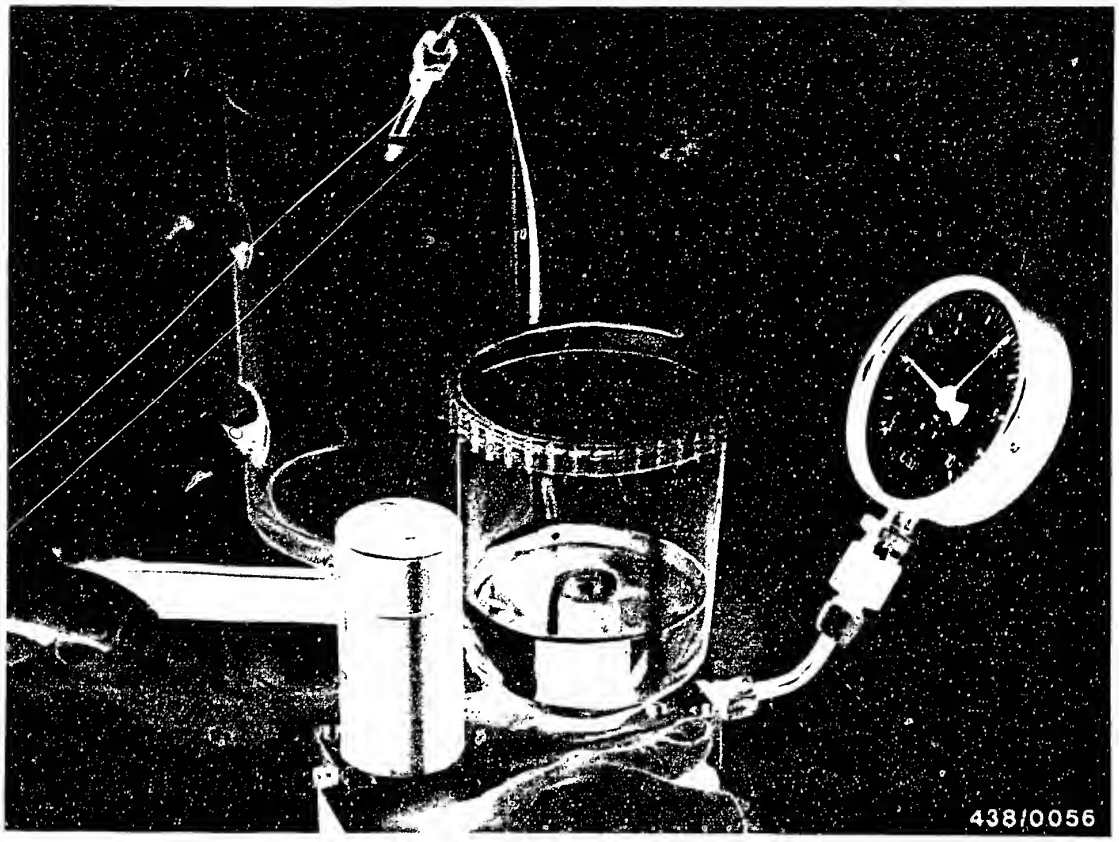


17.2 Removing the injection valves:

The injection valves are not plugged in as usual, but are screwed into insulating sleeves which in turn are screwed into the cylinder head (see sketch).

Removal is, therefore, only possible after previously unscrewing the fuel-injection lines.

In order to unscrew the fuel-injection lines, apply counter-force at the fixed hexagonal section of the injection valves.

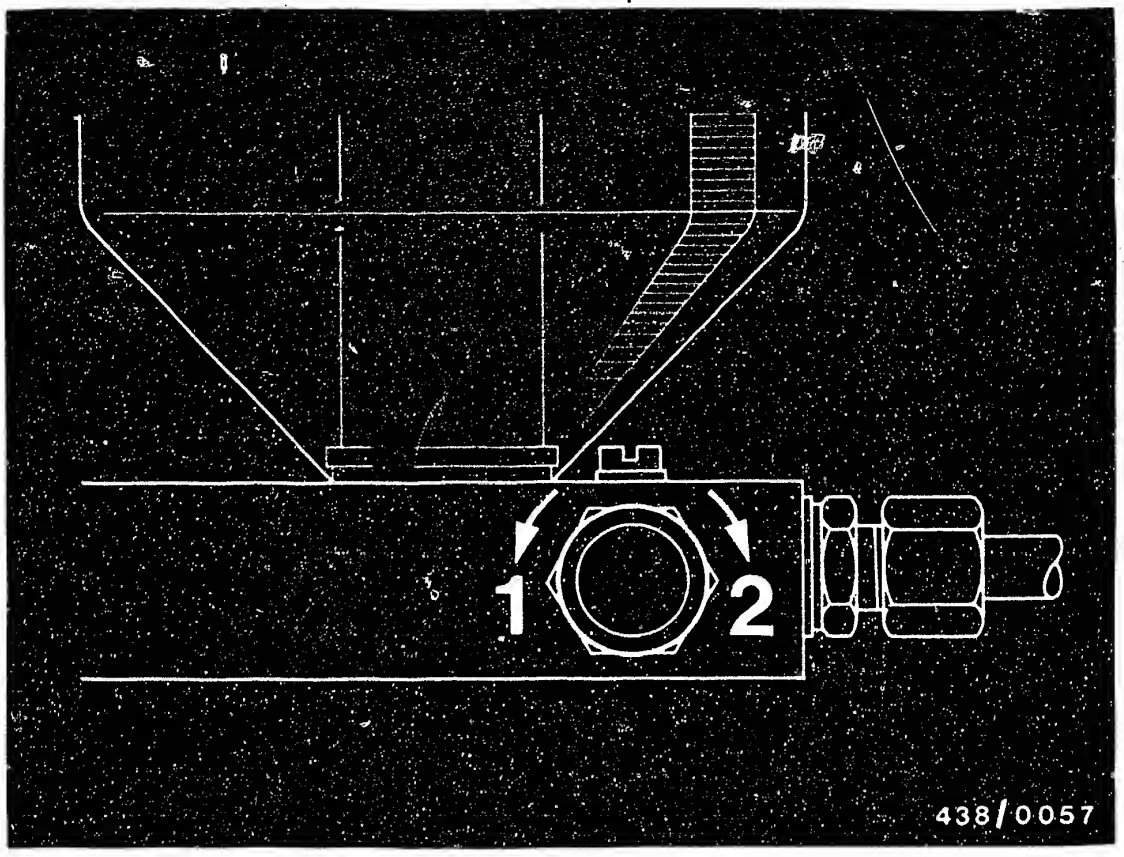


17.3 Connecting the injection valve to the tester

Remove injection valve for testing, connect it to valve tester and bleed the discharge tubing by moving the lever back and forth several times with the union nut open. Then tighten the union nut.

17.4 Checking for dirt

Move the hand lever slowly (approx. 2 seconds per stroke) back and forth with the stopcock on the pressure gauge open. If the pressure does not build up to 1...1.5 bar gauge pressure, the injection valve has a bad leak (caused, for example, by dirt stuck in it). You can try to flush the injection valve clear by moving the lever back and forth several times strongly.

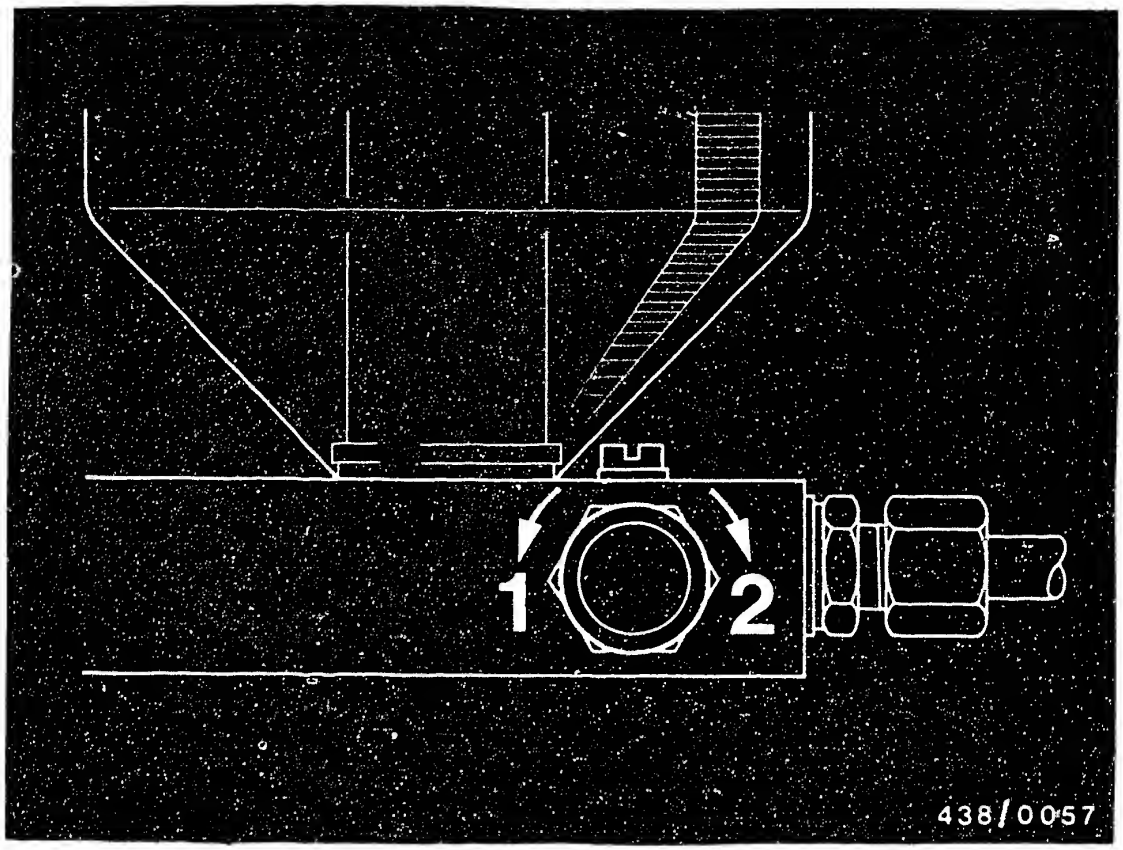


1 = Open 2 = Close

If this attempt is successful, continue the test. If it is not possible to flush the valve clear, replace it.

17.5 Testing the opening pressure

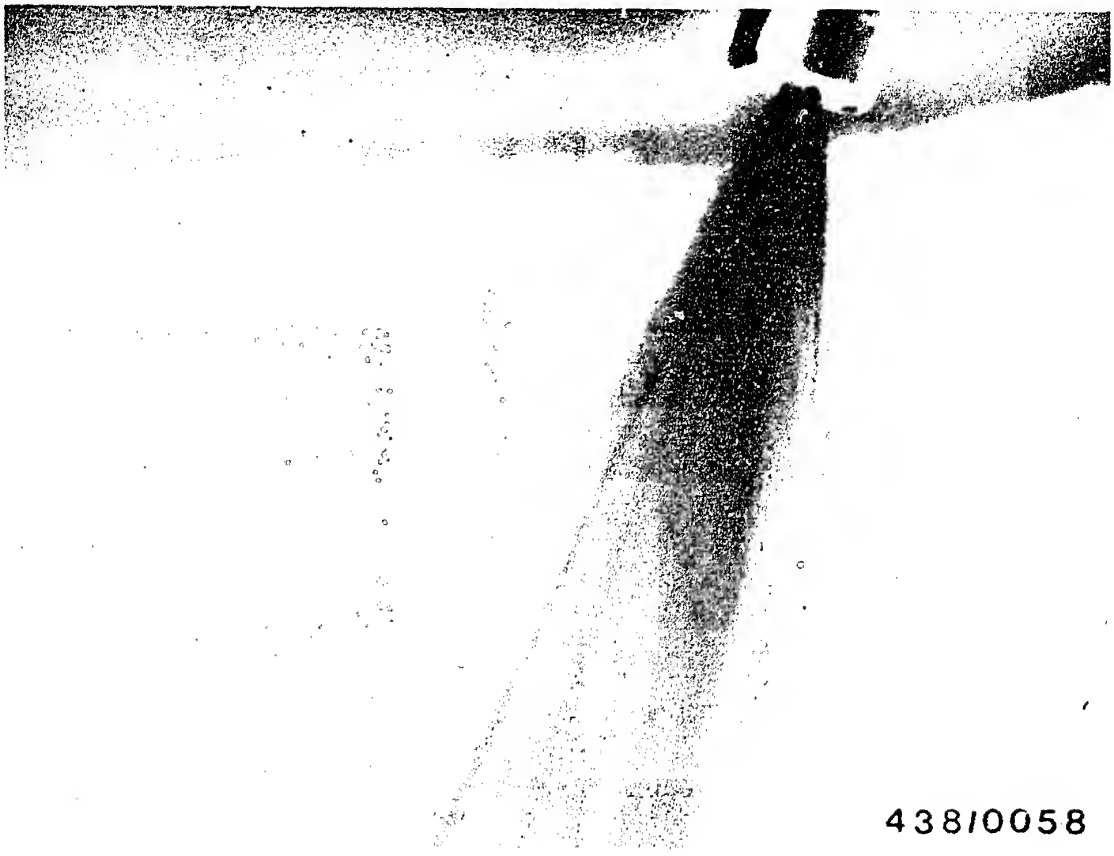
Injection valve Part No.:	Test specifications - opening pressure
0 437 502 017	2.7...3.8 bar (2.8...3.9 kgf/cm²) gauge pressure



With the stopcock closed, flush the valve out and bleed it with several rapid movements of the lever.
Open the stopcock and test the opening pressure by moving the lever slowly (approx. 2 seconds per stroke). If the opening pressure is outside tolerance, replace the injection valve. Individual valves can also be interchanged within a set.

17.6 Leakage test

Open the stopcock, build the pressure up slowly to a value 0.5 bar under the opening pressure determined previously (but not less than 2.5 bar gauge pressure), and hold it constant at that level. No drops must now fall from the valve for the next 15 seconds.

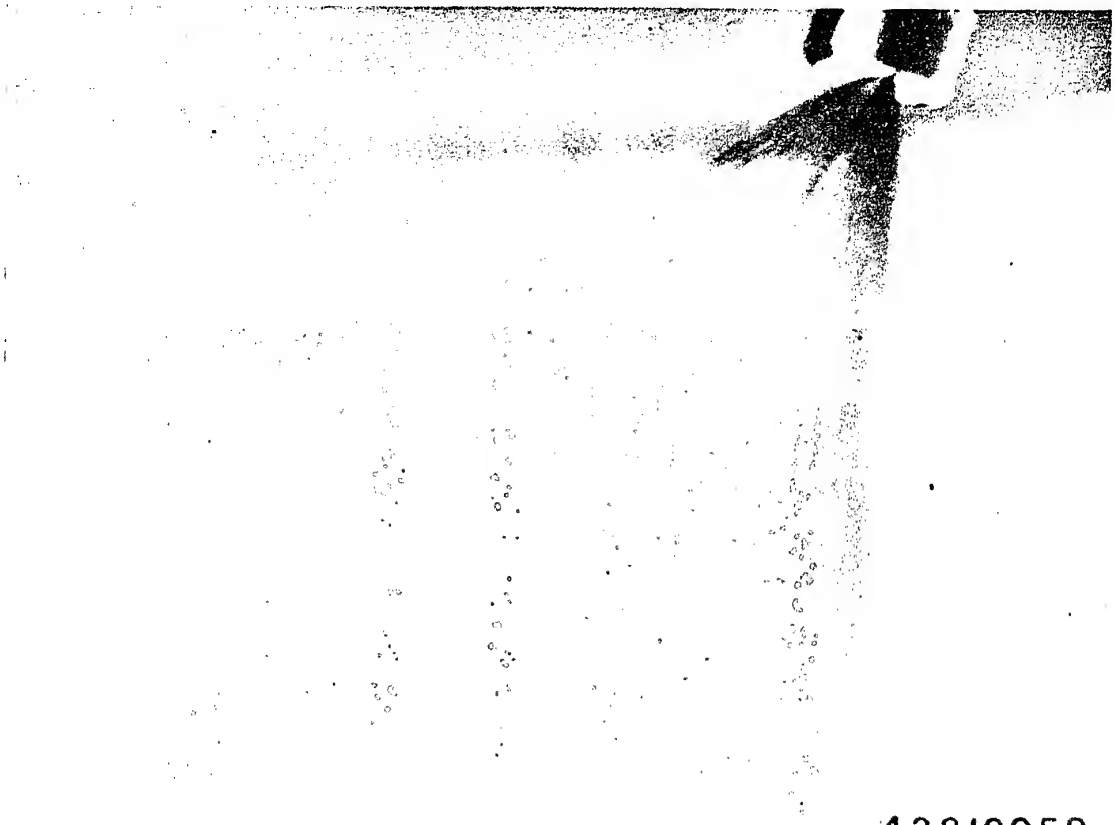


438/0058

17.7 Chatter test, evaluation of spray

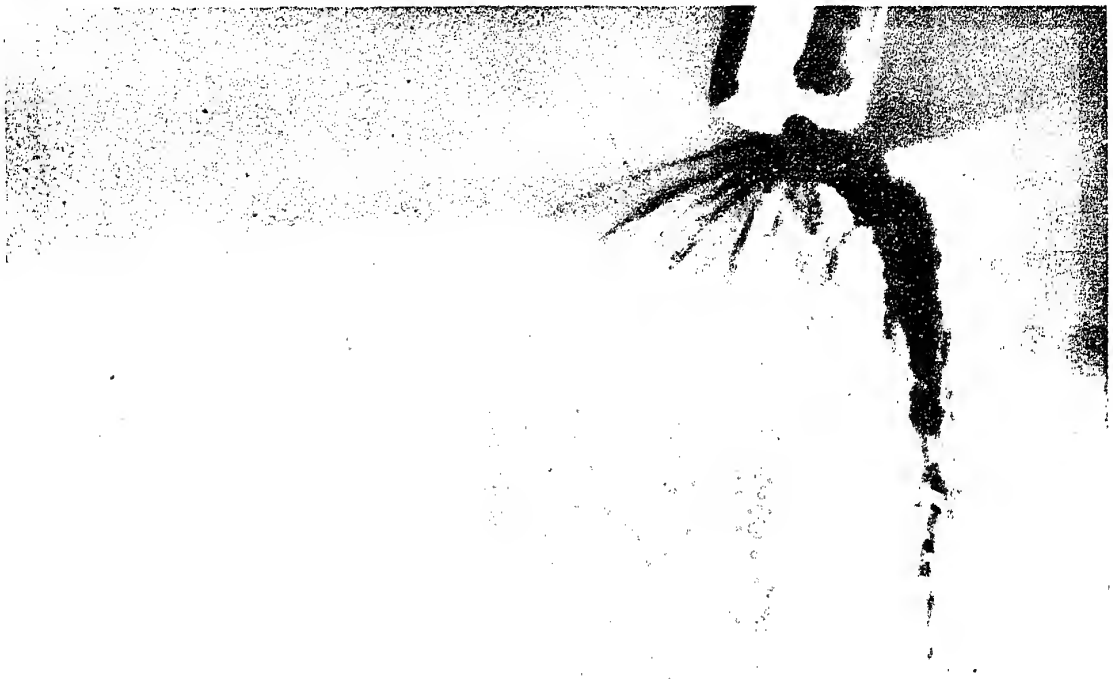
Move the lever back and forth at approx. 1 stroke per second. As this is done, the valve must chatter. No drops of fuel must form at the mouth of the valve. The valve must not produce a "cord spray". Formation of a single-sided, atomized spray within an overall spray angle of about 35° is permissible (see example given in illustrations).

Illustration shows good spray formation.



438/0059

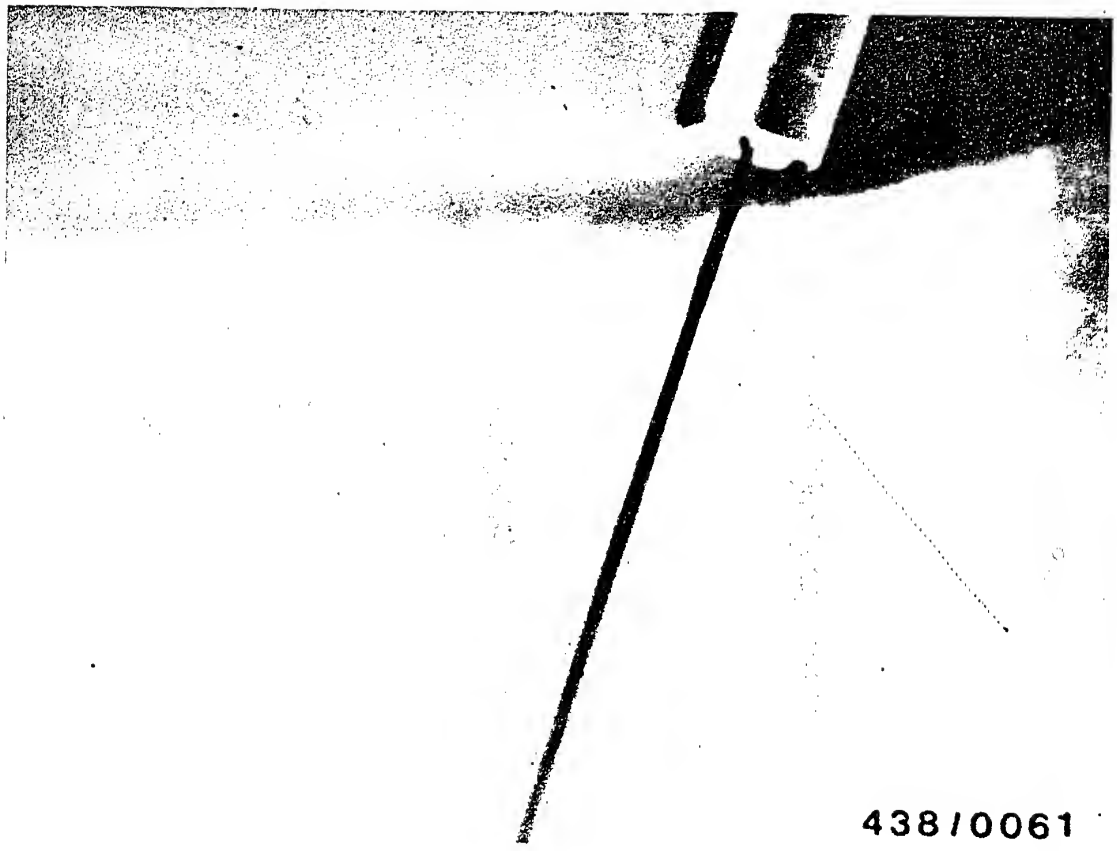
Illustration shows single-sided, but nevertheless good spray formation.



438/0060

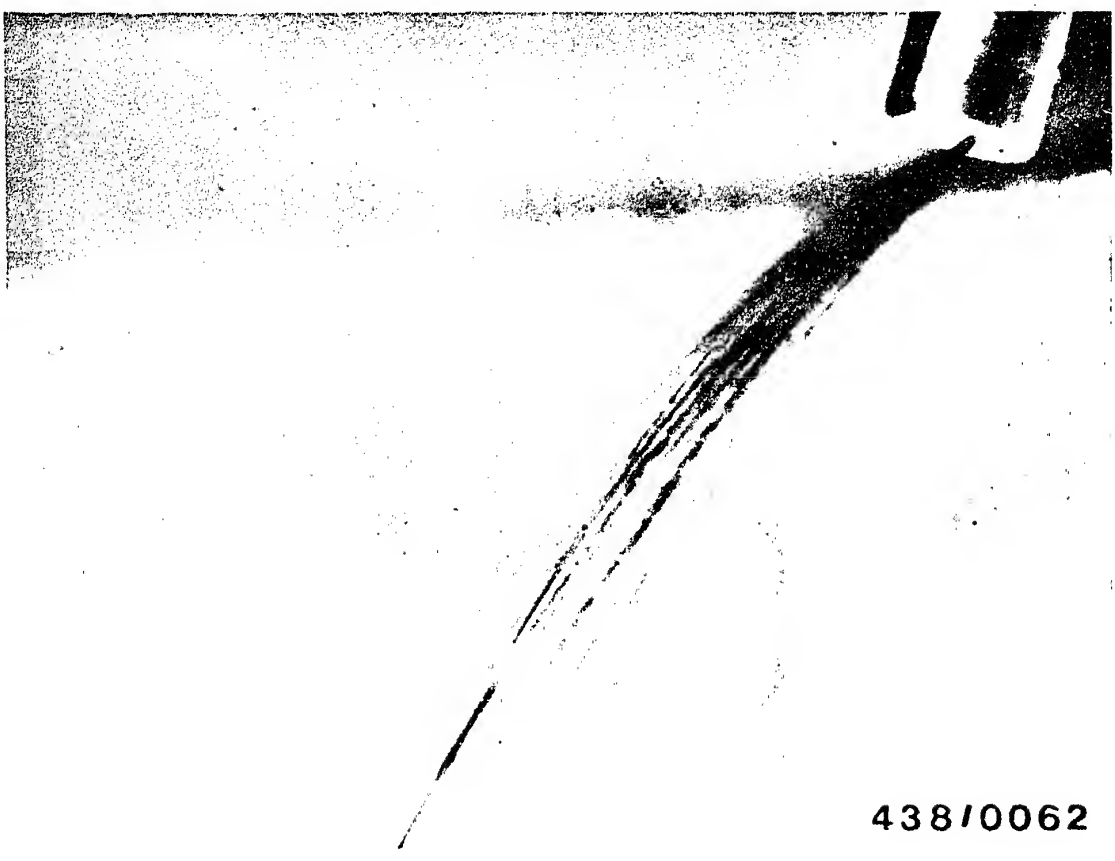
Poor spray formation; replace injection valves.

Illustration shows drop formation.



Poor spray formation; replace injection valves.

Illustration shows "cord" spray.



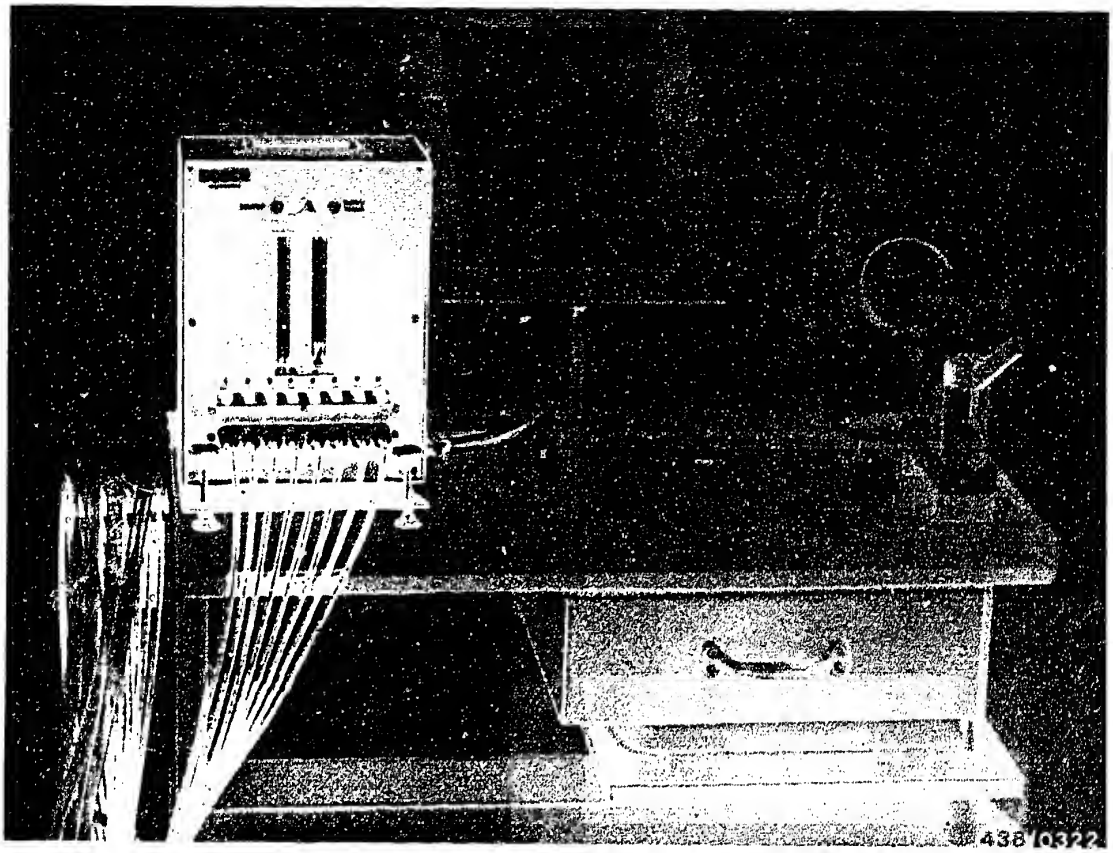
438/0062

Poor spray formation; replace injection valves.

Illustration shows "spray in strands".

If defective injection valves have been replaced, it is necessary finally to adjust the idle speed with the engine at normal operating temperature.

Idle-speed adjustment is described on Coordinate F 8.

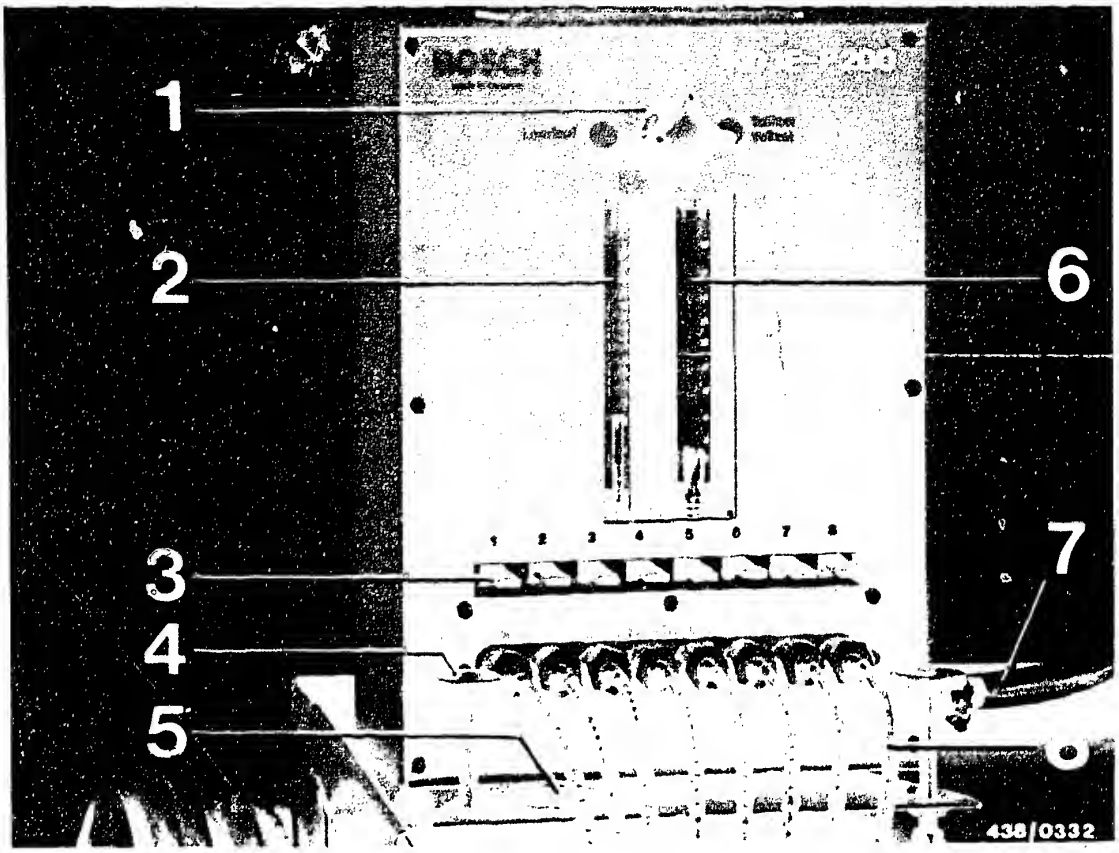


18. Comparative measurement of fuel delivery of fuel distributor outlets.

This test is carried out using the tester for delivered quantity comparison KDJE-P 200 (previously KDJE 7451).

18.1 Application:

By means of comparative measurements, the differences in the amounts of fuel delivered from the individual outlets on the fuel distributor are determined.
The tester is designed so that the test can be made on the vehicle without having to remove the fuel distributor.
Since the test is made with the original injection valves, the operator can recognize at the same time whether delivered-quantity scatter, if it occurs, is caused by the fuel distributor or by the injection valves.



1 = 3-way cock
2 = Small rotameter tube
3 = Keyboard for 8-way directional-control-valve
4 = Adjusting screw for setting up
5 = Spirit level
6 = Large rotameter tube
7 = Return hose
8 = Polyamide hose lines (test lines)

18.2 Construction

The tester is designed for use with all engines, up to 8 cylinders, equipped with K-Jetronic.

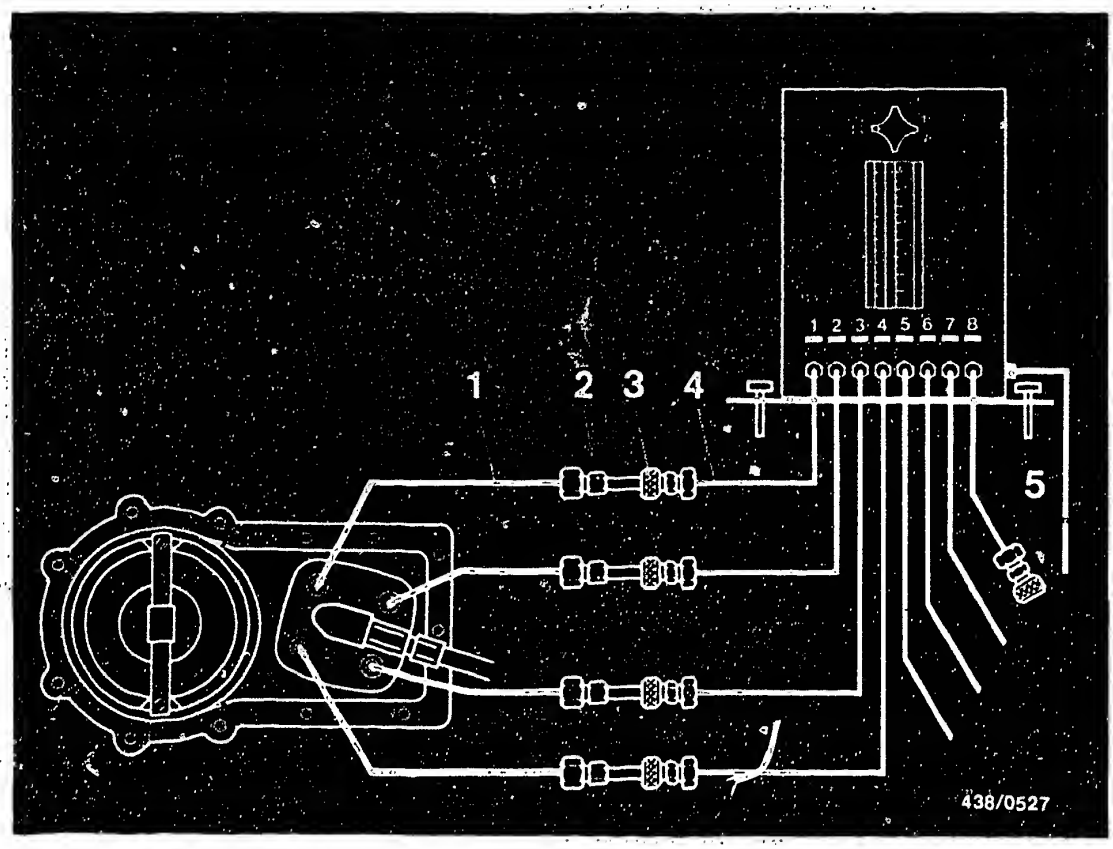
Basically, the tester consists of a steel housing containing 2 rotameter tubes with measuring ranges of 2...15 cm^3 and 10...180 cm^3, an 8-way valve for key operation (Item 3) and a 3-way stopcock (Item 1).

The small rotameter tube (Item 2) is used for the idle measurement while the large tube (Item 6) is used to measure the fuel delivery at part- and full-load. The particular rotameter tube to be used is connected by means of the 3-way stopcock. Using the 8-way valve, the fuel delivery of each cylinder is tested one after the other.

Attached to the tester are 8 hoses (Item 8), each terminated with an automatic connector. When the injection valves are withdrawn from their sockets on the engine they are attached to these connectors. Each automatic connector is fitted with a push valve so that no fuel can escape from connectors that are not in use (when 4- or 6-cylinder systems are tested).

The fuel is returned to the fuel tank through a hose (Item 7) about 5 m long.

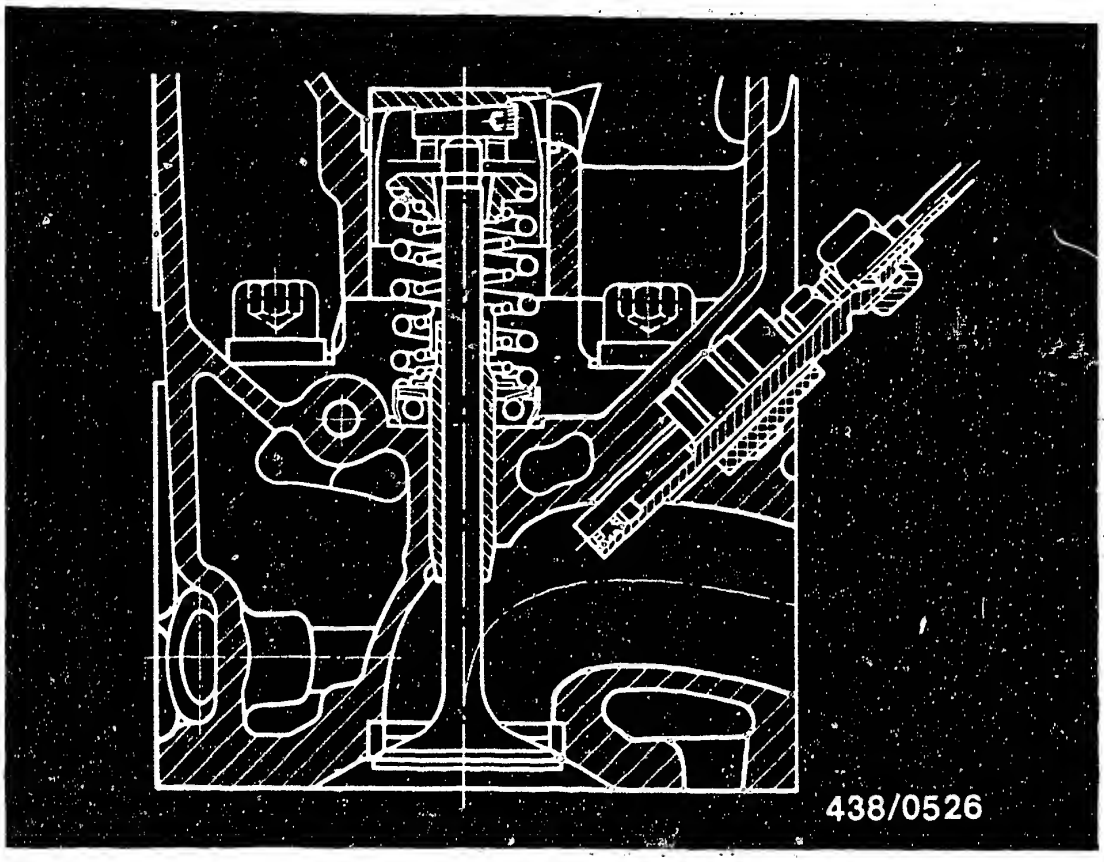
The entire test is made with a closed circuit, i.e. no fuel escapes.



1 = Adapter connection hoses from line set KDJE-P200/25. (Connection to fuel distributor with double threaded fitting M 8x1/M10x1)
2 = Injection valves
3 = Automatic connectors
4 = Tester hoses
5 = Return line to fuel tank filler neck

18.3 Setting up and connecting the tester for delivered quantity comparison:

Set the tester up beside the vehicle on a solid base (e.g. on tester trolley KDJE-W 100) and align it with the built-in spirit level at the base of the tester.

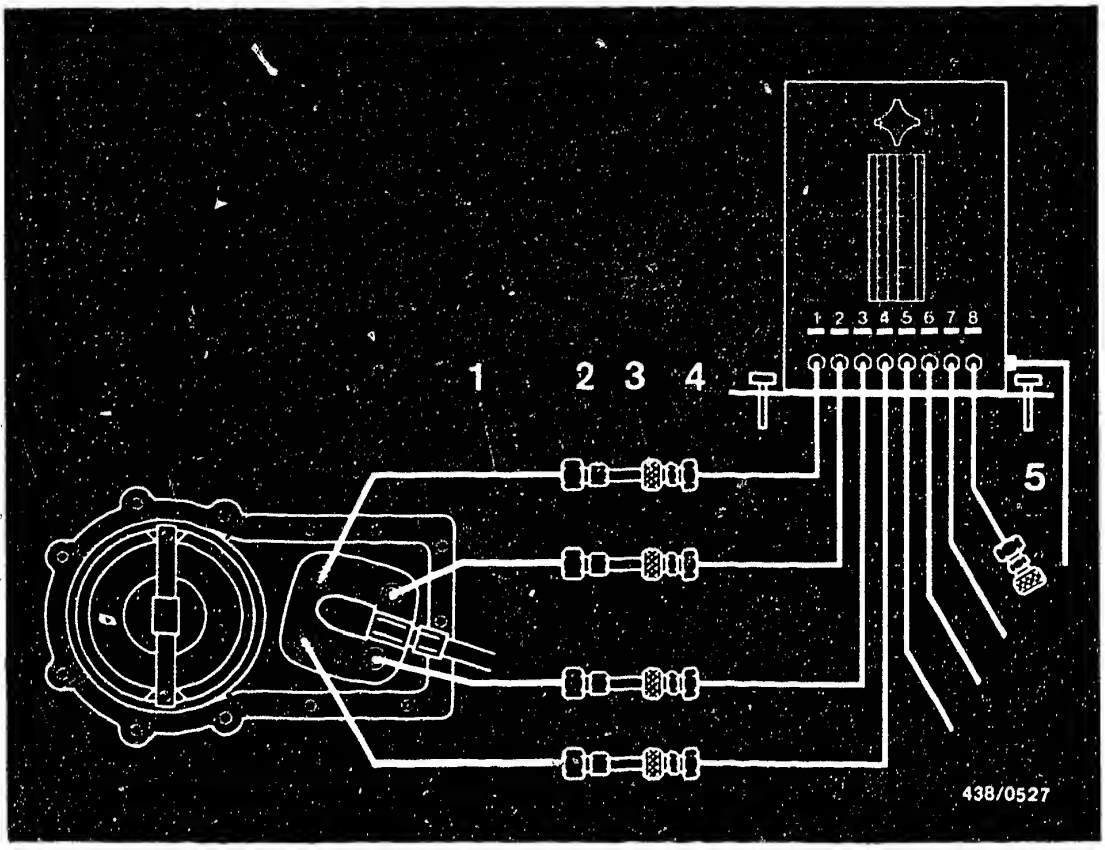


So that the rigid fuel-injection lines are not bent too much, the tester for delivered quantity comparison is connected using the adapter connection hoses KDJE-P200/25.

Remove the injection valves completely.

The injection valves are not plugged in as usual, but are screwed into insulating sleeves which in turn are screwed into the cylinder head (see sketch).

Removal is, therefore, only possible after previously unscrewing the fuel-injection lines.



Unscrew the fuel-injection lines from the fuel distributor and connect instead four adapter connection hoses using the double threaded fittings M10x1/M8x1.

Connect the injection valves to the adapter connection hoses.

Clean the injection valves with a rag and insert injection valves into the automatic connectors of the first four tester hoses.

Note:
Insert the injection valves as far as they will go and tighten the knurled thumbscrews well so that the non-return valves of the automatic connectors are opened fully.

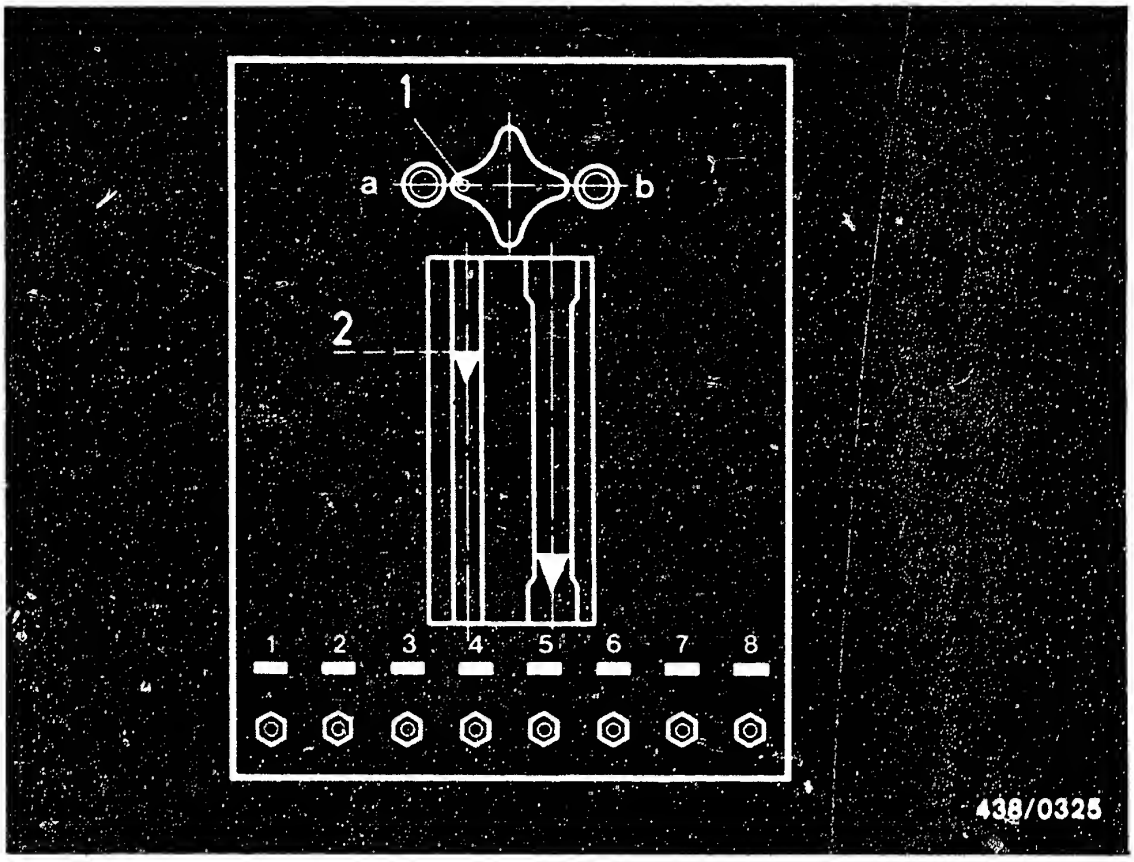
18.4 Bleeding the tester:

Remove the air filter so that the air-flow sensor plate becomes accessible.
Remove the electric plugs from the warm-up regulator and the auxiliary-air device.

Switch on the electric fuel pump by bridging the electrical safety circuit:
Press down the air-flow sensor plate to the stop.

Press the keys on the 8-way valve one after the other, while simultaneously switching the 3-way stopcock until both rotameter tubes are bled.

Return the sensor plate to the rest position.



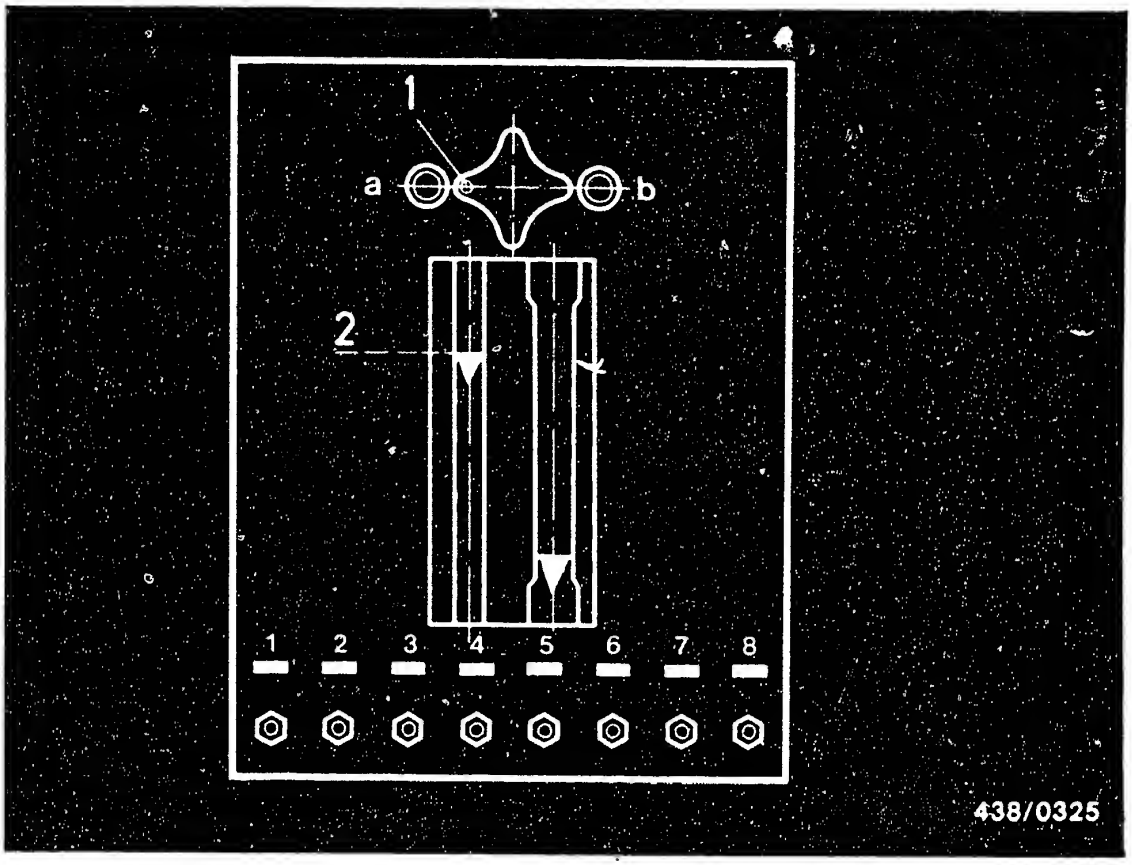
1 = White dot
2 = Measuring line

a = Idle
b = Part load/full load

18.5 Testing:

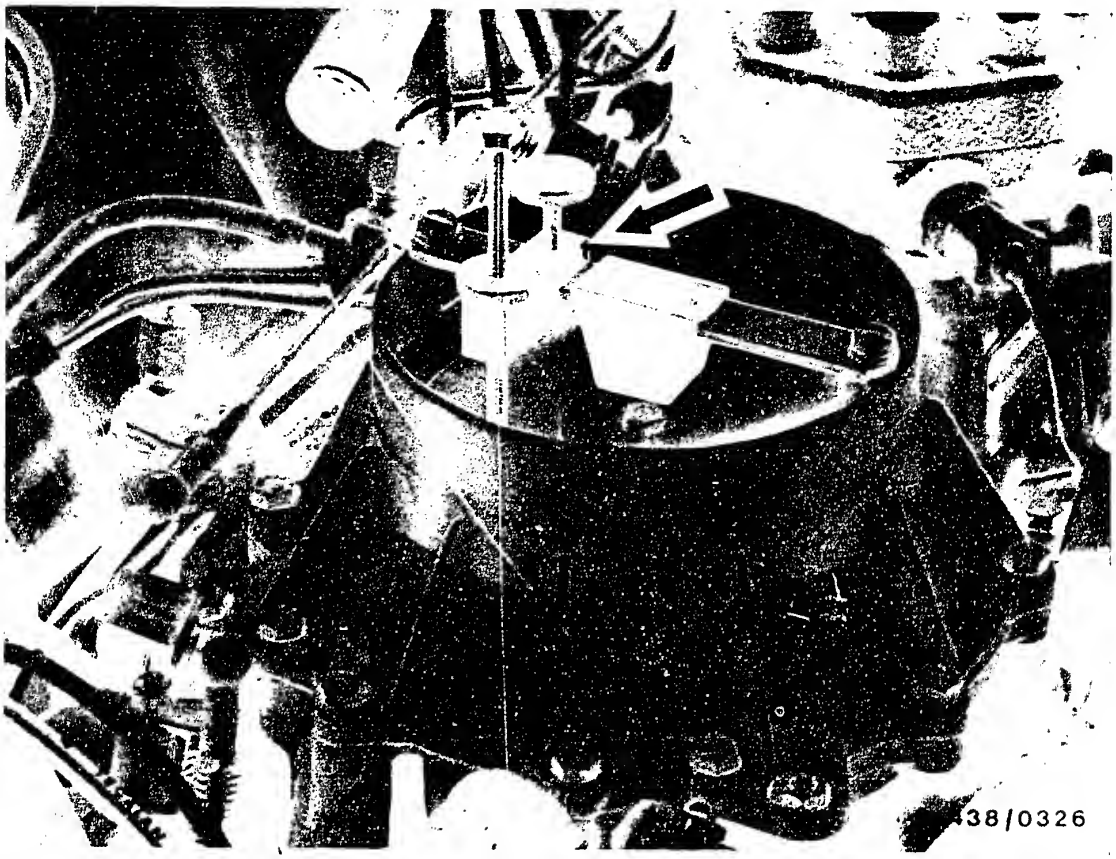
The flow comparison measurement is made in the idle, part-load and full-load ranges.

The small rotameter tube is to be used for the idle measurement (white dot to left on control knob); part-load and full-load measurements are made using the large rotameter tube (white dot to right).



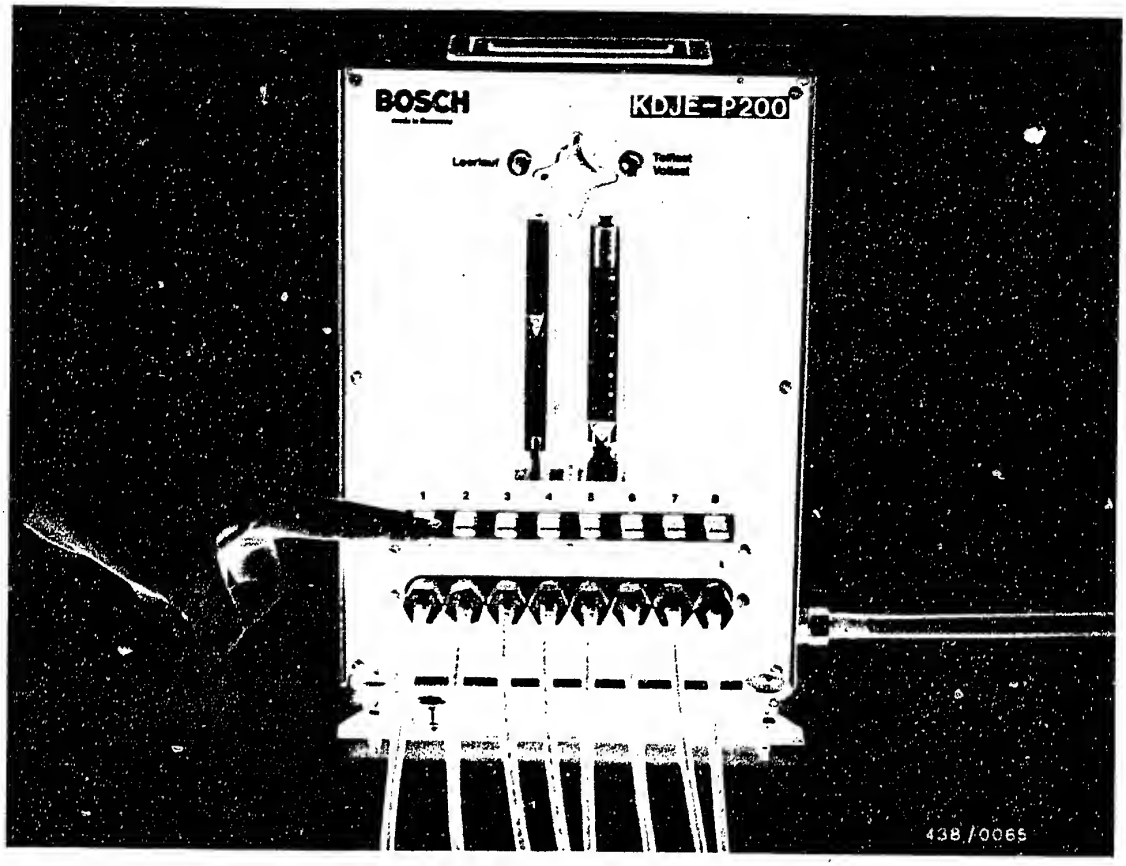
The delivered quantities indicated on the rotameter tubes are read off at the top edge of the conical float (Item 2).

On testers with a ball float the uppermost point of the ball is used for reading off. With each measurement be sure to wait until the float has reached its final position. This may take 20...30 seconds in the case of small deliveries.



The exact setting and locating of the position of the air-flow sensor plate for the various load ranges is done using the setting device KDJE 7456.

With the adjusting screw initially screwed all the way out, the setting device is clamped onto the stop bracket of the air funnel (arrow). Adjust the position of the air-flow sensor plate using the adjusting screw.



Fixed numerical values are specified in the following test section for the maximum permissible fuel delivery differences for the individual load ranges.

The "set point" value always pertains to the fuel-distributor outlet with the lowest fuel delivery, i.e. in each case the outlet with the lowest delivery is to be first ascertained.

Press the key for outlet 1. Pivot the air-flow sensor plate until the corresponding rotameter tube approximately indicates the "set point" value. Fix the air-flow sensor plate in this position.

Test the remaining outlets in order to determine which outlet has the lowest fuel delivery.

Press the key for this outlet again, and set the delivery precisely to the "set point" by correcting the position of the air-flow sensor plate. Then fix the air-flow sensor plate in this position again.

Press the remaining keys one after the other, and determine the maximum fuel delivery of each outlet. A deviation in fuel delivery can only be above the "set point".

18.6 Test specifications

	Setpoint (cm^3/min)	Maximum permissible fuel delivery (cm^3/min)
Idle	6.0	6.8
Part load	40.0	44.0
Full load	160.0	175.0

If the test shows too great a deviation in one of the three load ranges, the test should be carried out again to make sure.

If the result is confirmed, check whether the fault lies in the fuel distributor or in the injection valves.

To do this, change the injection valves with the greatest deviation with those with the smallest.

If the result remains the same, the fault lies in the fuel distributor. If the fault follows the fuel-injection valves, then these are defective.

Replace defective fuel distributor or injection valves.

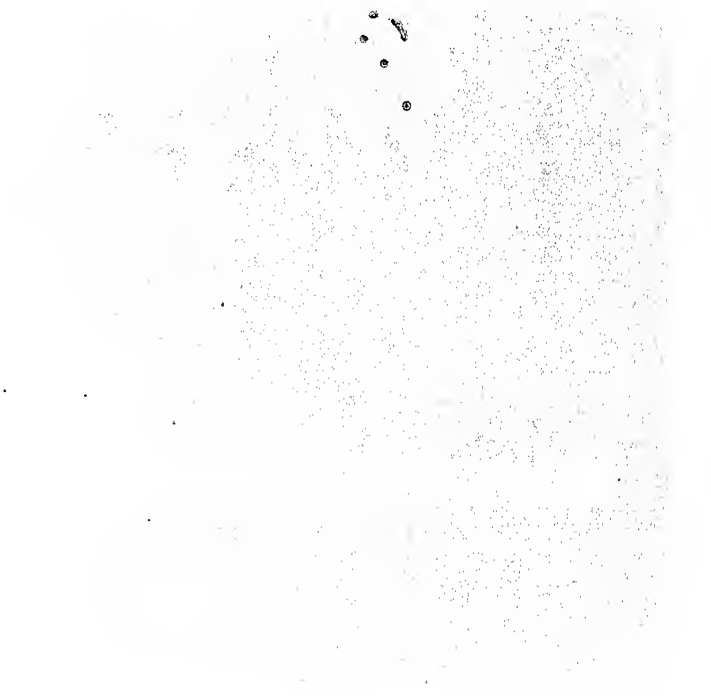
18.7 Final operations

Re-fit the injection valves properly. Also fit the air filter. Make sure that all lines are laid correctly.

Re-connect the electrical safety circuit of the K-Jetronic. Make sure that this is done properly.

By means of a trial run, make sure that all line connections are not leaking.

Finally, check the idle adjustment and, if necessary, correct (Coordinate F 8).



19. Idle adjustment

19.1 Test conditions:

Warm up the engine for the idle adjustment (oil temperature approx. 80°C).

Important note:

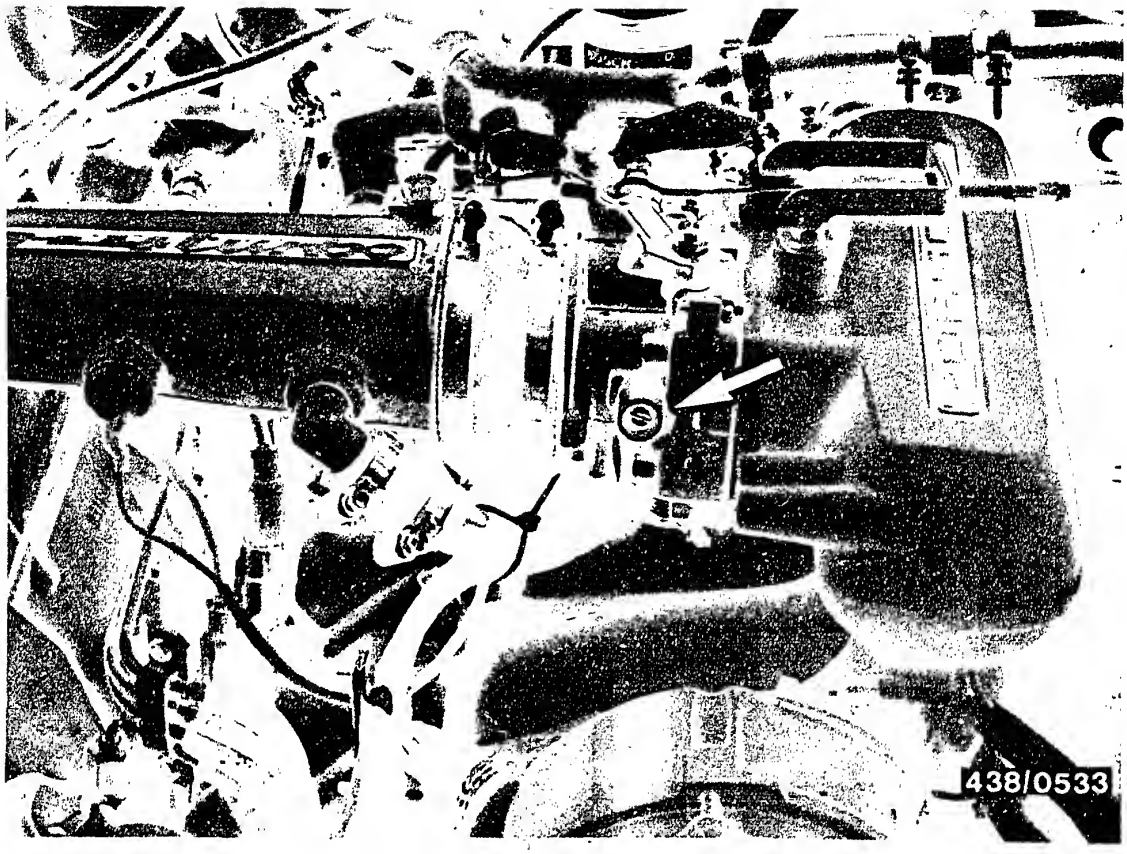
If the fuel-injection lines or injection valves were loosened or removed, the engine should be warmed up under load. The low rate of fuel flow during idling is not always adequate to drive all the air out of the fuel-injection lines.

The idle speed must not be adjusted when the engine is too hot, e.g. immediat ly after being raced or after a power measurement on the roller-type test stand.

In vehicles with an air conditioner, this should be switched off in order to stabilize the engine speed.
Engine-speed measurement with a separate tachometer.
The operating levers on the throttle-valve assembly were permanently set at the factory. The adjusting screws are lead-sealed and must not be changed.

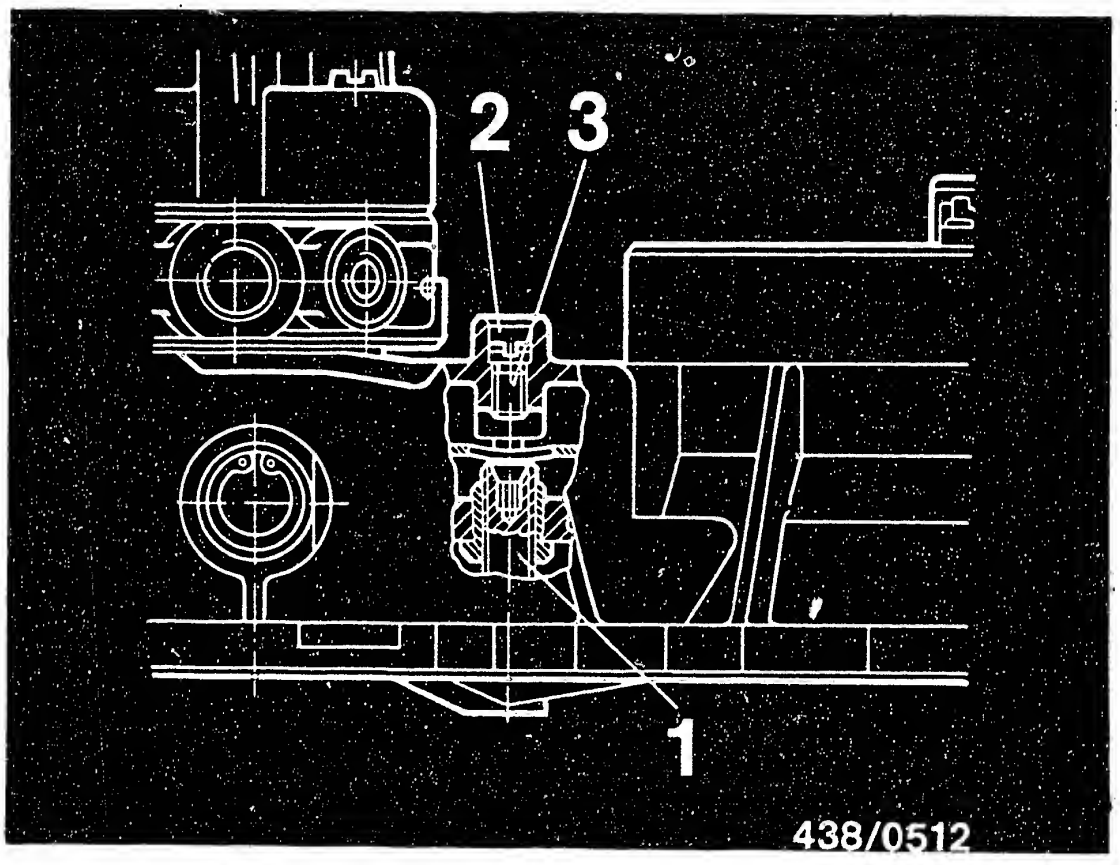
19.2 Test specifications and settings:

Idle speed:	850...950 min^{-1}
CO Concentration at idle speed:	0.5...1.0% by vol.



19.3 Adjustment:

The idle speed is adjusted at the bypass screw in the throttle-valve housing (arrow).



Adjust the CO concentration by turning the idle-mixture-adjusting screw (1) in the mixture-control unit using adjusting wrench KDEP 1035.

To get to the idle-mixture adjusting screw, remove the anti-tamper plug (2) and the screw plug (3) in the air-flow sensor housing.

Remove and fit the anti-tamper plug using tool set No. 13 10 90 from Cartool, Hans Schubert KG, Unterer Grasweg 88, D-8070 Ingoldstadt.

The adjusting wrench KDEP 1035 is passed through the housing bore and is inserted into the idle-mixture-adjusting screw.

Turning to the right = richer mixture
Turning to the left = leaner mixture

Caution: Always make the adjustment from the lean side, i.e. if the mixture is too rich turn the idle-mixture-adjusting screw further to the left than necessary, and then turn it to the right up to the setting required.

Remove adjusting wrench after every adjustment and close the bore, since unmetered air would otherwise distort the CO reading.

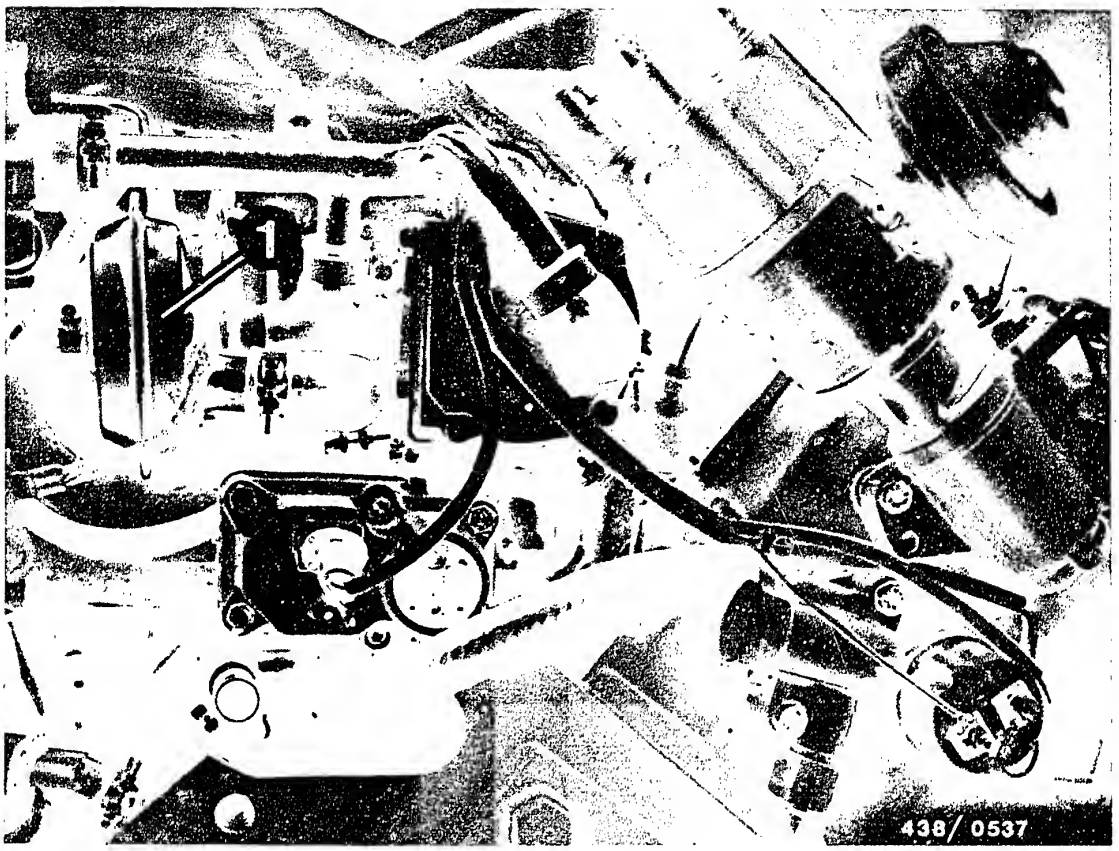
After every adjustment, accelerate the engine briefly so that the intake lines cool down. Then wait until the indication on the CO tester has stabilized. Never accelerate the engine with the wrench still in place as this could result in bending the control lever in the air-flow sensor.

19.4 Anti-tamper device for idle-mixture-adjusting screw:

In the Federal Republic of Germany, § 47 of the FMVSS/CUR, "Exhaust Gases and their Discharge", has been amended. This amendment order was printed in full in the Verkehrsblatt 13 of 15th July 1975.

Accordingly, all motor vehicles with externally supplied ignition produced as of 1st October 1976 must be provided with anti-tamper devices for the idle-mixture-adjusting equipment so that it is not possible to adjust the screw without destroying the anti-tamper device. The intention is to prevent non-experts from readjusting the idle setting and thus inadmissibly influencing the exhaust gas. Consequently, the anti-tamper caps may only be used in the workshop and must not be sold to customers for their own use.

These anti-tamper caps come in different colours. The cap to be used for the downdraft air-flow sensor in the after-sales service is blue. It cannot be obtained from Bosch but should be ordered from Deutsche Vergaser-Gesellschaft under the part number K 34 520.



19.5 Checking the vacuum limiter:

The vacuum limiter (1) is a vacuum-controlled auxiliary-air device which opens only on the overrun. In all other operating conditions the vacuum limiter must be tightly closed.

The vacuum limiter can be checked as follows:

Measure the idle speed with the vacuum limiter closed (engine at normal operating temperature). Then switch off the engine.

Remove the hose connection before the throttle valve on the throttle-valve assembly and seal off the hose and tailpiece tight. Start the engine again and measure the idle speed. It must not differ from the previous measurement. If the engine speed has dropped, the vacuum limiter has a leak. If it is leaking badly, the idle speed is too high and can no longer be adjusted.

Replace the vacuum limiter if leaking.
If it has been necessary to replace the vacuum limiter, subsequently check or repeat the idle adjustment.

After-sales Service

Technical Bulletin

Packaging of goods under warranty

438

K-Jetronic (CIS)

VDT-I-438/101 B
10. 1976

All components or assemblies of the K-Jetronic which are dispatched under warranty must be correctly and carefully packaged so that no further damage or impairments occur during transit, since these would not be covered by warranty.

Any fuel remnants must be removed from those K-Jetronic assemblies intended for dispatch, so as to eliminate any danger of fire during transit.

The intake openings and outlets of the assemblies must be sealed off with caps or plugs. As new products were fitted, the caps or plugs from these may be used.

The plunger of the fuel distributor is to be fitted with a protective cap of adequate size, or secured to the fuel distributor.

In addition, the assemblies are packed in tightly packed, well-sealed plastic sleeves. Fuel distributors and warm-up regulators are packed individually.

If components arrive damaged due to incorrect packaging or do not comply with these instructions, they can be returned and the warranty claim rejected.

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After-sales Service

Technical Bulletin

Securing of idle-speed adjusting screws

K-Jetronic (CIS)

438

VDT-I-438/102 B
11.1976

According to a statutory regulation, changes have been made to § 47 of the German traffic licensing laws concerning exhaust gases and their outlets. This regulation was printed in full in traffic law sheet 13 of 15.7.75 .

Consequently, all motor vehicles with external-ignition engines must have their idle-speed adjusting devices secured from the 1st October 1976, so that adjustment of the screw is impossible without destroying the securing device. This should stop unskilled people from adjusting the installation of the idle-speed system and thereby illegally influencing the emission values. As from now, securing caps can only be used in the workshop and cannot be sold to customers for their own use.

Securing caps are produced in various colors. For after-sales service the following caps and colors are used:

downdraft air-flow sensor
Blue — securing cap is not available from BOSCH. Part number is DB 000.997.59 86 from the Deutsche Vergaser Gesellschaft K 34 520 .

updraft air-flow sensor
Red — Part number 3 430 522 002

These stipulations are only valid in countries where ECE regulations (Economic Commission for Europe) apply. The air-flow sensors must however be converted for the use of these securing caps, as a matter of principle. The caps can also be used in countries not subject to ECE regulations, to prevent dirt penetrating through the pipe to the adjustment in the case of updraft air-flow sensors.

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After-sales Service

Technical Bulletin

SUPPLY PUMPS 0 580 ..

Overview of the non-return valves

Replaceable non-return valves

Part Number	Appropriate seal ring	Fitted in supply pumps
1 583 385 004	1 580 203 002	0 580 254 990, ..991,..998
.. 006	.. 002	.. 985
1 583 386 008	.. 001	.. 987, ..988,..989
.. 011	.. 001	.. 986, ..996
.. 014	.. 001	.. 992
.. 016	1 580 105 001	.. 970, ..971,..972, .. 973, ..974,..980

Parts sets (comprising non-return valve complete with seal ring)

1 587 010 001	-	0 580 254 992
1 587 410 901	-	.. 978, ..982 FD823→

Supply pumps fitted with non-replaceable non-return valves

0 580 254 975, ..976, ..977, ..979 and ..982 → FD 822

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After-sales Service

Technical Bulletin

HOT-STARTING PROBLEMS

438

VDT-I-438/105 En
3.1980
Replaces Ed. 2.1980

K-Jetronic

Hot-starting problems can occur in various vehicles fitted with K-Jetronic. This means that when an engine is switched off whilst still hot and then switched on again after a short period, it does not start as well as it should.

The engine, the ignition system and the K-Jetronic system in these vehicles should be carefully checked. With the K-Jetronic particular attention should be paid to the:

complete system (in case of leaks),
injection valves (in case of leaks),
correct position of the air-flow sensor plate (rest position).

Instructions can be found in the vehicle-related repair manuals VDT-W-438/5.. .

If the engine still does not start satisfactorily when hot, even after checking, a timing relay can be fitted in K-Jetronic systems which are not equipped with a solenoid valve for reducing the control pressure as additional starting help.

Timing relay 0 340 000 003 controls the start valve during hot starts. The start valve then injects extra fuel intermittently (sometimes cutting out completely.

The timing valve is fitted according to the wiring diagram (see reverse side). The fitting of this relay will be charged for.

After fitting the timing relay starting should be carried out as follows:

Vehicles with start valve in intake manifold - with open throttle valve,
Vehicles with start valve in idle duct - with closed throttle valve.

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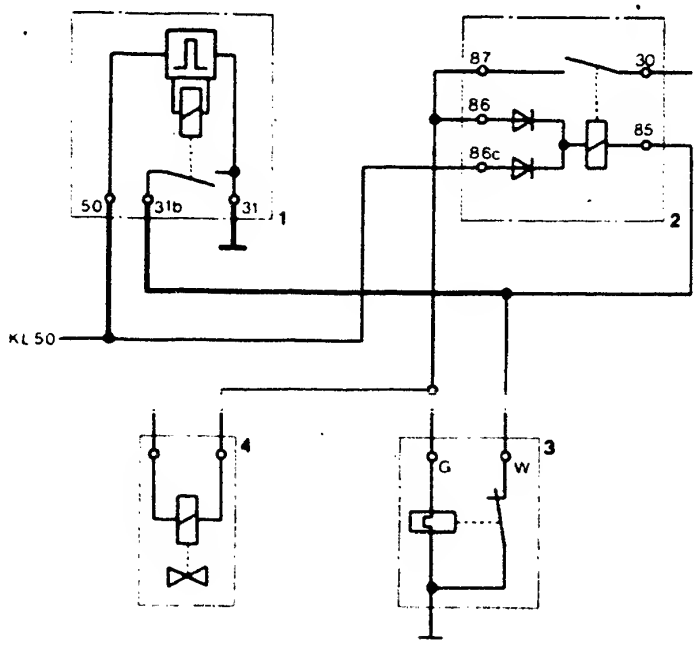
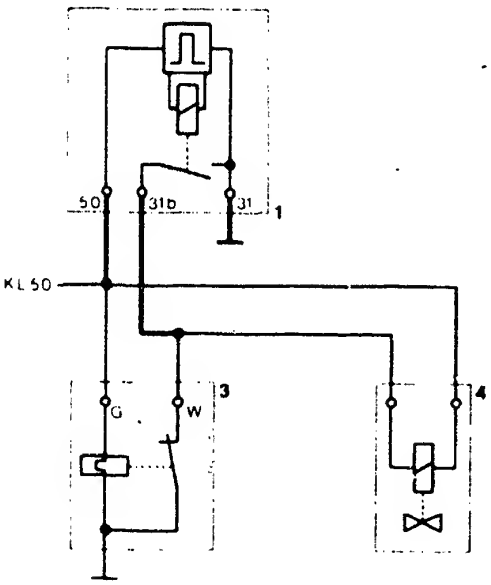


K-Jetronic system with post-injection relay

1 = Timing relay 0 340 000 003
2 = Post-injection relay
3 = Thermo-time switch
4 = Start valve



K-Jetronic system without post-injection relay

After-sales Service

Technical Bulletin

TUBE FITTING WITH FILTER IN WARM-UP REGULATOR 0 438 140 ...

VDT-I-438/106 En
4.1980

Warm-up regulator 0 438 140 065, used in MB 230 E, has a filter in the tube fitting for the fuel inlet to prevent dirt getting in.

When other warm-up regulators with the same connections give trouble or fail because of dirt getting in, then we recommend that you fit the new warm-up regulator with this tube fitting with filter, part no. 1 433 356 802.

During assembly a flat seal ring A 10 x 14 DIN 7603-C-CU, part no. 2 916 710 649, is laid underneath and the tube fitting is tightened with 20...22 Nm (2.0-2.2).

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After-sales Service

Technical Bulletin

FIRMLY FITTED NON-RETURN VALVE

VDT-I-438/107 En

Repairs
fuel pumps 0 580 254 ...

5.1980

Previously fuel pumps with non-exchangeable non-return valve (see VDT-I-438/104 En) had to be exchanged completely in cases of leakage in the non-return valve.

If the fuel pump is in working order and only the non-return valve leaks, there is now the possibility of repairs as part of after-sales service. 2 parts sets have been produced for this purpose, they contain, amongst other things, a tube fitting with built-in non-return valve.

Before using the parts set the installation conditions should be checked. The defective non-return valve can remain in the fuel pump which does not have to be dismantled for fitting the parts set. Before disconnecting the fuel lines the pressure fittings of the fuel pump and the fuel lines should be thoroughly cleaned.

Description and fitting

Parts set 1 587 010 003 for fuel connection with inlet union.

Screw the tube fitting (short side) with the thick flat seal ring into the pressure fitting and tighten. In doing so press against the hexagon of the pressure fitting with a wrench. Place the thin flat seal ring, the fuel-line inlet union and the other flat seal ring on to the long side of the tube fitting and tighten with the hexagon cap nut. Run the engine and check that there are no leaks in the connection.

Parts set 1 587 010 004 for fuel connection with nipple and union nut.

Screw the tube fitting with flat seal ring into the pressure fitting and tighten. In doing so press against the hexagon of the pressure fitting with a wrench. Screw the fuel line to the tube fitting with a union nut and tighten. Run the engine and check that there are no leaks in the connection.

BOSCH Geschäftsbereich KH Kundendienst, Kfz-Ausrüstung

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